JAMAICA

ANNUAL REPORT

OF THE

Department of Agriculture

FOR THE

YEAR ENDED 31ST DECEMBER, 1933

Ordered by His Excellency the Governor to be printed.

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DEPARTMENT OF SCIENCE AND AGRICULTURE, JAMAICA.

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Public Gardens.

Superintendent and Plant Breeder	M. S. Goodman.
Horticulturist	E. Downes.
Clerk	Miss E. Marson.

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Agricultural Chemist	H. H. Croucher, B.Sc.
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Clerk and Storekeeper	L. A. Boothe.

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Entomologist	W. H. Edwards, D.I.C., F.E.S.
Geneticist	L. N. H. Larter, B.Sc., A.R.C.S., A.I.C.T.A.
Supervising Inspector of Plant Diseases	J. B. Sutherland.
Inspectors of Plant Diseases	18 Inspectors.

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Superintendent Sugar Cane Experiments	M. S. Goodman.
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Headmaster Farm School	J. W. Howe, B.S.A., M.Sc.
Assistant Masters	L. A. Powell, H. C. Virtue, V. A. Valentine
Superintendent Grove Place Stud Farm and Experimental Station	A. F. Thelwell.

Live Stock.

Veterinary Surgeon	S. Lockett, V.M.D.
Superintendent Hope Stock Farm	J. W. Howe, B.S.A., M.Sc.
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Clerk, Grove Place Stud Farm	R. N. Lewis.

DEPARTMENT OF SCIENCE AND AGRICULTURE.

Report for the year ended 31st December, 1933.

I. GENERAL.

The Department of Science and Agriculture was administered by Dr. S. Lockett, Government Veterinary Surgeon, during the period 1st January to 1st February, 1933. From the 2nd February to the 15ht September, Mr. F. E. V. Smith, Government Microbiologist, acted as Director of Agriculture. Mr. A. C. Barnes assumed duty as Director of Agriculture on September 16th, 1933. In these circumstances, little progressive development was possible during the year but the normal services of the Department were well maintained and, in particular, the two new scientific divisions of Agricultural Chemistry and Plant Genetics got well into their stride, while the foundations of the Citrus Extension Scheme were firmly laid. The staff of the Department is to be complimented upon an excellent year's work carried out under exceptionally difficult climatic conditions.

Divisional reports indicate the widespread nature of departmental activities and record real progress for the year.

A feature of the year was the holding of the West Indies Fruit and Vegetable Conference in Jamaica during October, in connection with which the Department played an active part as the Director was a member of the Jamaican Delegation, while the Microbiologist acted as Secretary to the Conference. Mr. F. A. Stockdale, C.M.G., C.B.E., Agricultural Adviser to the Secretary of State, visited Jamaica in order to attend the Conference and the opportunity was taken of conferring with him on important problems connected with departmental working and general Island agricultural activities. The opportunity of meeting senior officers and representatives from other West Indian Colonies was welcomed, and informal discussions on varied subjects connected with agriculture proved a useful feature of the Conference Week. The recommendations of the Conference afford a most valuable outline of agricultural policy in relation to the development of the fruit and vegetable growing industries, and the closer association and better understanding developed as a result of the Conference amongst the Agricultural Departments of the various participating Colonies should lead to good results in the near future.

On my arrival in the colony, I embraced early opportunities of meeting representatives of organisations interested in agricultural development and, amongst other things, endeavoured to lay the foundations of better understanding and closer co-operation between the Department of Science and Agriculture and the Jamaica Agricultural Society. Plans were also made for the holding of a Departmental Staff Conference which could not, however, be held until January, 1934, and thus does not fall within the present review.

I desire to place on record my warm appreciation of the manner in which the Staff of the Department and Officers of the Produce Inspection Division and the Jamaica Agricultural Society received me. I am sensible of the loyal co-operation of the whole of the Staff of the Department, which, I trust, will be maintained and cemented with the passage of time.

The year, 1933, was one of abnormal weather conditions. The storm of November, 1932, was followed by a dry period which continued until May, 1933. The Island rainfall for the months of January to May, 1933, was 13.84 inches—41% less than the average of 23.77 inches for 60 years. The latter half of the year was characterised by exceptionally heavy rainfall, amounting to 102.69 inches, which was 106% above the 60-year average. Two weather disturbances during this period occasioned considerable damage to life, property and crops. On August, 15th a weather disturbance of slight to moderate intensity developed SSE of the Island and moved WNW. Great flood rains, causing loss of life and serious damage to roads and property, fell in the eastern and central parishes during the night of August 15/16. On October 28th, a weather disturbance developed SE of the Island and moved WNW, increasing to hurricane force during the night of the 28th. It passed over the western parishes on the 29th causing considerable destruction to property and cultivation. The rainfall in October amounted to 28.43 inches, which was the highest mean monthly fall during the past 63 years. The records indicate that the eastern half of the Island received proportionately more rain than the western during the year.

These exceptional weather conditions focussed the attention of agriculturists generally on three important matters—the susceptibility of the Gros Michel banana to damage by winds of moderate intensity; the desirability of exploring underground sources of water for irrigation purposes and the serious effects of soil erosion during periods of heavy rainfall on denuded areas. Apart from direct damage by wind and floods to bananas, the increased incidence of Panama Disease in banana cultivations on lands subject to flooding was apparent during the year, and interest in the production and testing of immune varieties of banana, as well as in types which would stand wind damage better than the Gros Michel, was evidenced to a greater extent.

The development of the use of underground water for irrigation purposes, received an impetus during the dry months of 1933, which has resulted in a considerable increase of the number of wells from which water is drawn for irrigation purposes in the plains of St. Catherine and St. Andrew. This phase of irrigation work is by no means new as there has been considerable activity in the boring of tube wells during the past five years. It is stated that in Vere and mid-Clarendon alone there are between 250 and 300 wells, old and new. In the plains of Saint Catherine there appears to be room for still further development of underground water for irrigation purposes to supplement the Rio Cobre Canal. Of several wells installed during 1933, the largest delivers 1,200/1,300 cubic yards per hour. More than twenty tube wells have been sunk in the Liguanea plains, most of them having capacities of about 80 cubic yards per hour.

Various factors have contributed to the serious forest destruction and denudation of the higher lands of the Island, which in their turn contributed to the very heavy soil erosion which became so noticeable during the latter half of the year 1933. Considerable interest is being displayed by the agricultural population in re-afforestation and the checking of erosion on steep hillside cultivations opened up during recent years by small settlers. The Department of Agriculture and the Jamaica Agricultural Society have played an active part in encouraging the planting of useful trees, while considerable interest is being displayed by planters in various parts of the Island. The destruction of useful growth by uncontrolled fires, started by persons with the object of preparing their lands for cultivation, was very marked during the early part of of 1933 and again directed public attention to the necessity for strict control of scrub fires.

The unusual weather conditions of the year exercised their most marked effect on the production of bananas which had already suffered severely as a result of the storm of November, 1932. The re-establishment of plantations was hindered by the dry weather of the early part of the year, and plantations which were coming into bearing again suffered by the storms of August and October, while occasional Northers, particularly one in September, caused serious losses in certain parishes. The exports of bananas were approximately one-half of those for the year1932, the actual figures being:

1932....20,360,613 stems (13,764,020 counts)
1933....10,557,369 stems (6,001,861 counts).

A review of the year's production of other crops will be found under Chapter VI of the Annual Colonial Report for 1933.

With only $3\frac{1}{2}$ months experience of the Island and of the administration of the Department of Science and Agriculture during 1933, it is not possible to discuss from personal experience the year's activities, but it is felt that comprehensive records of divisional activities, published as part of this Report, indicate clearly the main lines of work pursued during the year.

A. C. Barnes.
Director of Agriculture.
July 25th, 1934.

II. PUBLIC GARDENS.

Report of the Superintendent and the Horticulturist.

1. Hope Gardens.

Weather.—The high winds during the summer months, which were the result of hurricanes passing near the Island, caused small damage to trees and small plants in the Gardens. The total rainfall in the Garden for the year was 113.28 ins. against an average of 51.90 ins. for the past 52 years.

Orchids.—The health of the plants in the Orchid collection has been maintained and a succession of flowers was to be seen in the Orchid House during the year. At one period there were 540 blooms exhibited in the House.

The excessive rainfall caused a number of the plants to develop weak growths but, speaking generally, the majority of the plants stood up to the frequent heavy rains very satisfactorily.

A small collection of hybrid *Calanthes* was obtained from Messrs. Sanders, St. Albans, England, in exchange for some native orchid plants of *Broughtonia sanguinea*. The Calanthes have grown successfully under our climatic conditions. Their easy culture, the lasting quality of the blooms and time of flowering (November—February) should attract the attention of local florists who are interested in the supply of cut blooms to hotels and tourists.

Steady progress has been maintained in the growth of the young hybrid seedlings which were germinated by the asymbiotic method during 1931 and are now growing under natural climatic conditions. A number of seedlings have been placed into 4″ pots and some now have leads 6 inches long.

The following is a list of the successful crosses made during the year:—

C. Dowiana aurea x C. triumphans festiva
C. Hardyana regalis x C. Dowiana aurea
C. Hentschelii x C. Eleanore
C. Dowiana aurea x C. gigas—F. M. Byrodt
C. labiata x C. Bletchleyensis
C. labiata x C. Bowringiana
C. labiata x C. Fabia brugense
Lc. Black Prince x C. labiata
Laelia Digbyana x C. triumphans festiva
Blc. Caligula x Bc. British Queen

Flower Beds and Borders.—The layout of the beds along the main drive was remodelled. Half-circular beds were opened up between the palms and the beds which were formerly arranged around the base of the palms were filled in and converted into lawn. The re-arrangement of the beds gives a better effect to the main drive when the beds are filled with flowering plants. Better results are now obtained with the various subjects planted in these beds than was ever possible when the young plants had to struggle for existence against the palm roots.

The practice of using *Poinsettias* for formal landscape gardening was introduced along the main drive with pleasing results. Cuttings of the pink and red *Poinsettias* were planted in the nursery in April and grown on under favourable conditions so that by August good, strong, rooted plants were obtained. These plants were taken up at that time, cut back to the fourth joint of the new growth and then planted about one foot apart in the beds. The plants re-established themselves and by November they had made new growths of about 18 inches high which produced heads of coloured bracts.

Similar results can be obtained with several of the flowering shrubs by cutting back their growth a short time before their flowering period. This practice could be well adopted by those who desire a more lasting floral effect in the formal layout of their gardens than can be obtained by the use of annuals, the flowering habits of which are usually so short-lived in the lowlands.

The border in front of the Office was cleared of the *Bougainvillea* Lady Wilson and replanted with *Allamanda Hendersonii*. A wire structure supported on iron rails was constructed to support the trailing growths.

A border of Poinsettias was established along the boundary fence between the Gardens and the Kingston and St. Andrew Corporation Water Works. The border is 600 feet long by 12 feet wide. Cuttings of the red and pink *Poinsettias* were planted in the border in April and by November a remarkable development of growth had been made, chiefly owing to the constant rainfall during the summer months. The plants came into bloom in November and created a colourful and pleasing effect along what was in the past an unattractive boundary fence.

Extensions.—A piece of land at the western end of the Wild Garden was cleared of some poorly developed Coffee trees and was laid out and planted in Bahama Grass. This site will provide additional space for plants which are constantly being imported from Gardens abroad.

Sunken Garden.—Further progress was made towards the completion of this Garden. The site s 774 feet long by 90 feet wide and is enclosed with a dry packed stone wall which is 1½ to 1 foot thick and 5 feet high with a fall of one foot at regular distances to conform with the gradual slope of the ground level A cement capping covers the top of the side walls and cement was also used for constructing the steps and stone uprights at the eastern entrance. Flower beds have been made along the base and top of the side walls.

The slow progress of the Sunken Garden is due to there being no special fund provided for its construction and work could only be carried out when the Garden labour was available.

Plant Houses.—The double Plant House which was old and in a very bad condition and considered beyond repair was condemned. A new structure is now being erected on the same site.

An extension was made to the Orchid Seedling House to accomodate the hybrid seedlings in their early stages of growth.

Plant Introductions.—Mr. A. C. Barnes, F.I.C., B.Sc., A.M.I.Ch.E., Director of Agriculture, brought with him from Fiji a wardian case of ornamental plants and presented them to the Gardens. Six nuts each of hybrid dwarf coconuts No. 83 and No. 106, bred in Fiji, were also presented. Three of each of these varieties have already germinated.

Mr. J. E. Higgins, Director, Canal Zone Experiment Gardens, Summit, Canal Zone, presented to the Gardens a collection of Hibiscus cuttings. Some of these have already flowered and are of special merit.

Aleurites montana.—In 1932 two plants of *Aleurites montana* were set out in the nursery but hardly made any growth until 1933 when the rains started. One of these plants was destroyed by an animal and was replaced by another in July. Owing to the heavy rains this plant started into growth immediately. It appears that the *A. montana* will thrive in the plains if the rainfall is sufficient for its requirements.

Grant of Plants to Turks and Caicos Islands.—At the request of His Excellency the Governor, Sir Ransford Slater, fifty Breadfruit plants were presented to the Turks and Caicos Islands. The plants were packed and shipped on the 17th October on H.M.S. Danae on which vessel His Excellency sailed on a visit to these Islands.

Routine Work.—The routine work of the maintenance of the Gardens and the propagating and distributing of nursery stock was regularly attended to.

Correspondence.—During the year 2,559 letters were received in this office and 1,575 letters were sent out, not including sterotyped circulars which are sent out in reply to letters in connection with the purchase of plants and replies to interdepartmental minutes.

Literary Contributions and Lectures.—The Superintendent of Public Gardens contributed an article to the Journal of the Jamaica Agricultural Society on "Grape Vine Culture" and gave a lecture on "The Necessity of Nurseries for providing Sugar-cane Seed Pieces" to the Agricultural Instructors and members of the public who attended the Open Week organised by the Department during the month of July.

The Horticulturist also contributed an article to the Journal of the Jamaica Agricultural Society on "Orchid Culture in Jamaica" and gave a lecture and demonstration during the Open Week on "Various Methods of Propagating Plants."

Visitors.—A large number of tourists visited the Gardens during the winter and summer months.

During the year the Gardens were also visited by: Dr. A. B. Rendle, M.A., D.Sc., F.R.S., F.L.S., Keeper of the Department of Botany, British Museum (Natural History), London; Dr. T. Barbour, Museum of Comparative Zoology, Harvard College, Cambridge, Mass.; Dr. David Fairchild, Coconut Grove, Florida; Prof. J. H. Faull, Harvard University; Prof. J. S. Dash, Director of Agriculture, British Guiana; F. G. Walsingham, Harvard University Gardens, Soledad, Cienfeugos, Cuba.

PLANTS DISTRIBUTED FROM HOPE GARDENS, 1933.

Sold.

Economic Plants—	
Coffee	8,656
Cacao	..
Citrus-Seedlings	6,334
Citrus-Budded Plants	752
Mango—Grafted Plants	1,506
Miscellaneous	11,937
	29,185
Ornamental Plants	11,817
	41,002

Free Grants.

Economic Plants—	
Coffee	..
Cacao	..
Citrus—Seedlings	24
Citrus—Budded Plants	107
Mango—Grafted Plants	14
Cane Tops and Cuttings	226,864
Elephant Grass Cuttings	500
Timber Trees	16,102
Miscellaneous	250
	243,861
Ornamental Plants	3,608
	247,469
Total Number of Economic Plants	273,046
Total Number of Ornamental Plants	15,425
Total Number of Plants Distributed	288,471

The following statement shows the distribution of plants for the past five years from the Nursery at Hope:—

	1933.	1932.	1931.	1930.	1929.	Total.
Coffee	8,656	15,891	28,044	39,660	50,581	142,832
Cacao	..	194	76	247	313	830
Citrus—Seedlings	6,358	52,740	31,584	65,494	13,225	169,401
Citrus—Budded Plants	859	1,122	1,010	1,633	968	5,592
Mango—Grafted Plants	1,520	865	1,322	1,729	676	6,112
Cane Tops and Cuttings	226,864	261,233	171,337	143,002	144,087	946,523
Elephant Grass Cuttings	500	9,500	9,800	17,600	20,640	58,040
Timber Trees	16,102	10,767	56,864	37,898	45,198	166,829
Miscellaneous Fruit and Economic Plants	12,187	8,373	6,643	3,113	4,510	34,826
Ornamental Plants	15,425	27,167	33,183	31,288	30,847	137,910
	288,471	387,852	339,863	341,664	311,045	1,668,895

2. CASTLETON GARDENS.

Ornamental Shrubberies.—The vigour of the flowering and ornamental foliage shrubs following the general pruning of all the shrubberies in the previous year has been most satisfactory. The continuous rains have greatly improved the health of the plants and a rejuvenation of plant life has been obtained in every direction.

Nursery.—The heavy rains which fell in the Castleton District during August and October caused the river to overflow its banks, the water rising to the nursery beds and washing away hundreds of young propagated plants, but apart from the loss of young plants which have already been replaced by new material, the Gardens did not suffer any material damage.

Aleurites montana.—A number of young plants of *Aleurites montana* which were set out early in the year and are growing on the hillside to the west of the Palmetum are about three feet high and are growing satisfactorily. Two plants which were set out about three years ago are about seven feet high and have started branching.

Fruit Trees.—The Mangosteen (*Garcinia mangostana*) produced a fairly large crop of fruits. The Sapucaia (*Lecythis Zabucajo*—) produced a fair number of nuts.

Routine Work.—The general routine work of billing lawns, opening flood drains, repairing pathways, forking and weeding borders and propagating plants for nursery sale was regularly attended to.

Visits.—The Horticulturist inspected the Gardens at regular periods on an average of two visits per month.

PLANTS DISTRIBUTED FROM CASTLETON GARDENS, 1933.

Sold.

Economic Plants	20
Ornamental Plants	627
	647

Transferred to Hope.

Economic Plants	540
Ornamental Plants	6,694
	7,234
Total Number of Economic Plants	560
Total Number of Ornamental Palnts ..	7,321
	7,881

3. PUBLIC GARDENS, KINGSTON.

Cannas.—The Victoria Park presented an attractive appearance with varieties of Cannas grouped in mass along Seymour Avenue and in beds set out across the lawns. The abnormal rainfall in Kingston during the second half of the year greatly improved the condition of the plants and as a result much stronger growth and larger blooms were obtained.

The Cannas grown in the Victoria Park are selected varieties which, among many other varieties, have been tested out under the climatic conditions obtaining in Kingston and which have proved most successful under both dry and wet conditions. The following is a list of Cannas that may be recommended both for their vigour and colour:—President, Nokomis, Ambassador, King Midas, Yellow King Humbert, Hungaria, Eureka, Orange Bedder, Orange Glory, Sheherazade, Mary Thilow, Aviation.

Protection of Lawns.—Iron rods were erected along the pathways wherever the public encroached on the edges of the lawns.

Water Lily Tank.—The Central Lily Tank was emptied and cleared of water weed and new mounds of earth prepared for replanting Water Lilies.

Pathways.—The pathways were frequently washed out by the heavy rains. This will always happen as long as the paths are surfaced with marl. The unfinished surface of the paths detract considerably from the neat appearance of the lawns and flower beds. The Department is unable to undertake the work of resurfacing the paths as it does not have the necessary equipment for carrying out this class of work.

Routine Work.—The general routine of maintaining the Victoria Park, the lawns around the Public Buildings, the Memorial Square, the Old Treasury Site and Headquarter House Gardens, was regularly attended to.

4. HILL GARDENS, CINCHONA.

No new work was undertaken in these Gardens during the year apart from the general routine of maintenance. The heavy rains which fell during October and December caused a good deal of damage to pathways and fences and consequently the Foreman's time was mainly occupied in repairing these damages.

Xmas Trees.—A large number of Pines and other suitable trees were again supplied from the Cinchona woodlands to meet the demand for Xmas Trees.

Miscellaneous.—The usual demand for Tree Fern Roots for potting orchids, moss and other miscellaneous plants was supplied from Cinchona.

Routine Work.—The usual routine work of mowing lawns, weeding and forking borders, repairing pathways and clearing woodland pathways was regularly attended to.

Visits.—The Horticulturist paid a visit of inspection to these Gardens in December, remaining in residence for four days.

Prof. J. H. Faull of Harvard University paid a visit to the Gardens while on a collecting trip in the Blue Mountains.

5. King's House Gardens.

The Department was in charge of the Vote for the Maintenances of the King's House Gardens and Grounds up to the end of June when the Vote was taken over and administered by the Governor's Private Secretary, but the maintenance of the pastures remained under the control of the Department.

During the administration of the Vote for 1933-34 by the Department the following new works were undertaken.

New Rose Garden.—A piece of pasture land to the north of the Gardens was enclosed and cleared of trees and the site laid out for a rose garden. A stone wall, set in cement, was constructed from east to west and divides the layout into two sections. The rose garden is laid out on the upper section and is reached by half-circular steps which are set in the centre of the wall. The lower section is laid out and planted with a variety of subjects.

Formal Garden.—The lawn to the north of the Dining Room was laid out with a number of formal beds in which a variety of annuals are now grown.

Summer House.—This house which is situated on the eastern boundary of the Gardens was converted into an attractive Plant House with an ornamental arrangement of rockeries.

Tennis Courts.—The two tennis courts which had become infested with Seymour Grass and which had not been re-surfaced for a very long period had developed a very uneven surface. The courts were dug up and the Seymour Grass carefully picked out. Levels were then taken and the courts raised to prevent flood water flowing over them. A large quantity of soil had to be carted for this purpose. The grass was replanted and grew luxuriantly but owing to the continuous heavy rains clay could not be obtained for claying the surface until late in the year when better weather conditions allowed this work to be done. The courts have now been turned over in a condition fit for playing on.

Foreman.—Foreman Terrelonge was transferred back to Castleton Gardens as Propagator and Mr. T. P. O'Brien was appointed Foreman as from the 1st May.

Pastures.—The pastures under the care of Mr. Harold Bolton and Mrs. J. A. Crooks were maintained in a satisfactory condition. During the latter part of the year His Excellency the Governor issued a request that no further expenditure should be incurred on cleaning pastures under our control without his permission.

6. Gordon Town Garden.

The small garden at Gordon Town was maintained in a tidy condition out of the Hope Gardens Maintenance Vote.

7. Bath Garden and Nursery (St. Thomas).

Mr. R. Glen Campbell, Inspector of Plant Diseases, is in charge of this Garden and Nursery.

Distribution of Plants.—An arrangement was made the previous year to supply the St. Thomas Branches Associated with lime seedlings and 1,400 were supplied from the nursery at Bath. Seventeen hundred coffee seedlings were also supplied from this nursery.

Visitors.—There was a large number of visitors to the Garden during the year.

Routine.—The usual routine work was carried out and the Garden kept in a tidy condition.

Summary of Plants Distributed by the Department during the last Five Years.

	1933.	1932.	1931.	1930.	1929.	Total.
Coffee	10,356	15,891	28,044	39,660	50,931	144,882
Cacao	..	419	78	247	313	1,057
Citrus—Seedlings	6,358	52,760	31,584	65,494	13,225	169,421
Citrus—Budded Plants	859	1,122	1,010	1,633	968	5,592
Mango—Grafted Plants	1,520	865	1,322	1,729	676	6,112
Cane Tops and Cuttings	226,864	261,233	171,337	143,002	144,087	946,523
Elephant Grass Cuttings	500	9,500	9,800	17,600	20,640	58,040
Timber Trees	16,102	10,767	56,864	37,898	45,198	166,829
Miscellaneous Fruit and Economic Plants	14,147	8,463	6,734	3,872	4,954	38,170
Ornamental Plants	22,746	28,141	33,940	50,690	31,841	167,358
	299,452	389,161	340,713	361,825	312,833	1,703,984

9. The Garden and Plantation Sales for the last five years have been as follows:—

1933	£550 8 6
1932	613 1 9
1931	699 11 1
1930	761 19 9
1929	692 17 7

10. The Rainfall at the various Gardens for the year under review is as follows:—

1933.	Hope Gardens.	Castleton Gardens.	King's House Gardens.	Public Gardens, Kingston.	Hill Gardens, Cinchona.
	Ins.	Ins.	Ins.	Ins.	Ins.
January	1.26	0.19	1.45	0.45	0.35
February	0.09	2.03	0.00	0.00	0.29
March	1.63	13.80	0.69	0.95	6.33
April	0.17	2.36	0.10	0.00	0.44
May	1.83	10.08	1.23	2.85	2.28
June	12.02	34.55	12.86	11.40	17.03
July	13.45	19.91	10.66	10.66	11.56
August	18.61	46.35	*..	13.85	14.50
September	13.14	25.88	9.41	9.50	11.29
October	33.27	49.94	*..	17.46	44.19
November	12.28	38.48	9.56	6.30	27.88
December	5.53	54.63	4.97	1.10	34.28
	113.28	298.20	50.93	74.52	170.42

* Rain Gauge out of commission.

Rainfall for the Five Years 1929-1933.

Year.	Hope Gardens.	Castleton Gardens.	King's House Gardens.	Public Gardens, Kingston.	Hill Gardens Cinchona.
	Ins.	Ins.	Ins.	Ins.	Ins.
1929 ..	32.04	74.47	22.40	23.26	47.45
1930 ..	39.22	88.14	31.57	16.58	86.19
1931 ..	61.87	148.87	48.92	34.17	105.51
1932 ..	50.15	142.25	34.05	23.58	78.84
1933 ..	113.28	298.20	50.93	74.52	170.42

11. Contributions to the Gardens have been received from the following:—

Local.

J. B. Sutherland, Halfway Tree.
Dr. G. V. Lockett, Kingston.
Chas. Williams, Old Hope Road, Cross Roads.
H. Braham, Jamaica Citrus Producers' Association, Kingston.
Medical Superintendent, Lunatic Asylum.
Miss M. Austin, Mona, Liguanea.
Miss F. S. Cundall, Barneil, Halfway Tree.
W. Cradwick, Mandeville.
D. L. Feurtado, I.S.O., Unity Cottage, Halfway Tree.
Chas. Costa, Orange Valley, Brown's Town.
E. M. Brown, Surveyor General's Office, Kingston.

Foreign.

Prof. Juan Balme, Mexico.
Messrs. Vilmorin-Andrieux & Cie., Paris, France.
U. S. Department of Agriculture, Washington, D.C.
Lord St. Levan, St. Michael's Mount, Cornwall, England.
Dr. David Fairchild, Coconut Grove, Florida.
Harvard Botanical Gardens, Soledad, Cienfuegos, Cuba.
Messrs. Sanders, St. Albans, England.
Canal Zone Experiment Gardens, Summit, C.Z.
W. O'Brien, Corsley, Hyderabad, Deccan, India.
Dr. Wilson, Popenoe, Tela, Honduras.
Department of Science and Agriculture, Trinidad.
Department of Agriculture, Fiji.
Dr. Bonazzi, Cuba.
Royal Botanic Gardens, Trinidad.

M. S. Goodman,
Superintendent of Public Gardens.
E. J. Downes,
Horticulturist.

III. AGRICULTURAL EXPERIMENTS.

Experiment Station, Hope.

Report of the Superintendent.

Weather.—The rainfall from January to May was below the average and during these months there was no water available for irrigation. As a result, the young canes suffered badly. From June to the end of the year the rainfall was far above the average for the past 52 years, the rainfall at this station for the year being 113.28 inches of which 108.30 inches was deposited during the last seven months of the year. On August 15th over eleven inches of rain was recorded in a couple of hours and the flood water did considerable damage to the roads in the station, destroying the plots of cover crops which were about 6 inches high at the time.

Several times during the year the flood water from the hill to the north of the station flooded parts of the station and increased the damage to the roads.

During the year several hurricanes passed near the Island and the high winds damaged the sugar-cane and banana plots.

Distribution of Cane Varieties.—During the year 226,864 tops and cuttings of the different varieties of sugar-cane were distributed, making a total of 4,384,270 tops and cuttings distributed free to estates and small cane farmers for the past fourteen years.

It will be seen from the list below that the greatest demand was for those varieties which are highly resistant to Mosaic Disease and of good commercial value.

The following is a list of the varieties and quantities distributed for the five years 1929-33.

Varieties.	1933.	1932.	1931.	1930.	1929.	Total.
P.O.J. 2878 ..	74,869	112,538	33,549	4,628	..	225,584
P.O.J. 2725 ..	52,032	57,179	43,722	49,001	51,353	253,287
P.O.J. 2727 ..	22,922	21,807	18,594	35,123	15,774	114,220
Uba ..	22,797	31,200	46,204	27,874	44,374	172,449
P.O.J. 2714 ..	21,701	24,707	18,744	4,892	1,800	71,844
E. K. 28 ..	6,175	4,804	1,012	500	862	13,353
B. H. 10 (12)	5,135	1,012	2,111	1,150	12,172	21,580
B. 417 ..	5,036	998	484	2,080	3,855	12,453
B. 726 ..	4,315	400	..	..	..	4,715
B. 891 ..	4,015	400	..	..	..	4,415
S.C. 12/4 ..	3,675	2,659	2,936	2,555	3,324	15,159
White Transparent	2,878	1,196	2,034	1,162	1,525	8,795
Ba. 11569 ..	620	460	733	9,215	3,797	14,825
Co. 213 ..	200	500	..	..	..	700
Co. 281 ..	200	500	..	..	..	700
Mexican Striped	208	836	716	549	217	2,526
Badilla ..	50	25	..	400	206	681
H. 109 ..	36	12	..	600	1,870	2,518
C. H. 64/21	..	..	..	2,650	..	2,650
P.O.J. 2379	..	..	..	600	..	600
B. 1529 ..	..	..	500	13	1,384	1,897
P.O.J. 213 ..	..	..	..	..	800	800
C. 553 ..	..	..	..	..	562	562
B. 268 ..	..	..	..	..	200	200
J. 72 ..	..	..	..	..	12	12
Total	226,864	261,233	171,339	143,002	144,087	946,525

Cane Varieties.—Two new varieties of sugar-cane were introduced during the latter part of the year, viz.: Mayaguez 28 and Fajardo Central 916. These are under quarantine at the Government Laboratory and as soon as the quarantine is raised they will be cultivated at the Experiment Station for distribution. It is expected that small quantities of cuttings will be available for distribution during 1935. The above seedlings are the result of crosses between the P.O.J. 2725 and S.C. 12/4. In Porto Rico these seedlings have given a good account of themselves when grown in comparison with the B.H. 10(12) and S.C. 12/4, the standard canes of that Island.

The P.O.J. 2878 has been in great demand this year and large quantities were distributed to small farmers to resuscitate their fields which had been devastated either by Mosaic Disease in the susceptible cane varieties or by Panama Disease in the banana fields. With the good rainfall the ratoon plots have grown so fast that two distributions of cuttings were made from some of the plots. Two small plots of this variety were planted this year to assist in meeting the demand for this variety during the coming year. It has been demonstrated this year that this variety, when planted at wide distances apart, cannot stand up against high winds. Plots were planted at 6′x 6′, 5′x 5′ and 5′x 2′, and although all were damaged to varying extent from the high winds which resulted from passing hurricanes, the stools in the wide planting were uprooted while those in the close planting stood up better and were not uprooted.

The P.O.J. 2727, 2725 and 2714 have also been in demand and large quantities have been distributed.

The B. 726 and B. 891 which were introduced in 1930 have not shown very much promise under the conditions existing in the Experiment Station. B.726, although susceptible to Mosaic Disease, stands up better to the disease than B.891. Owing to the susceptibility of these two varieties to Mosaic Diseases, although they may be suitable and do well in certain of the cane districts, care has to be exercised in recommending them.

S.C. 12/4 is very susceptible to Mosaic Disease. One plot was so badly infected that it had to be dug out and replanted in P.O.J. 2878.

An old field of Uba ratoons was discarded and the field ploughed and cross ploughed and replanted in Uba. A field of old ratoons of the P.O.J. varieties was discarded and this field is being prepared for tomato experiments.

Bananas.—The following varieties are under cultivation:—Gros Michel, Robusta, Ram Kelat, Rubra, White House, Giant Fig, Apple, Cavendish and Pink Jamaica, a sport of the Gros Michel. The section containing old ratoons of these varieties were dug out and replanted. The other section suffered from drought during the early part of the year and again suffered from high winds due to passing hurricanes during the latter part of the year. It is proposed to replant this section during 1934. Trapping for Banana Borers (*Cosmopolites sordidus*, Silv.) was continued and very few were found. This method of control, when systematically carried out, has proved to be effective. The plots are grown chiefly for demonstration to the students and to provide material for the Geneticist.

Citrus.—No spraying was done in the Citrus Grove during the year as the 'Eddie Wasp' (*Eretmocerus serius*, (Silv.), a natural enemy of the Black Fly, has proven itself quite capable of keeping the Black Fly under control. A cover crop of *Crotalaria usaramoensis* was grown through the grove with a view of improving the soil and keeping down weeds. The trees have responded favourably both to this treatment and to the very good weather conditions experienced during the latter seven months of the year. Some of the budded trees in the young grove produced fruit during the year but as these were inferior fruit they were top-worked and budded with the Marsh Seedless Grapefruit. A new nursery of approximately five square chains was planted out with sour orange stock and over two thousand have already been budded with Marsh Seedless Grapefruit buds. During the year 859 budded Marsh Seedless Grapefruit plants were sent out from these nurseries.

Coffee—Owing to the severe drought during the first part of the the year the Coffee crop was a very small one. Some of the young trees in the recently planted plot died during the drought owing to insufficient shade, but it is hoped that the *Erythrina* trees that are now growing will provide sufficient shade in the future. It is quite an established fact that coffee will not thrive in the lowlands except when well shaded.

Cacao.—This plot is attended to by the Farm School students. They do all the work of pruning picking the pods, fermenting and drying. During the year all pods and fallen leaves were gathered and buried in holes between the rows. A small crop was reaped due to the severe drought in the early part of the year.

Cassava.—The following varieties were set out through the young citrus grove and will be reaped in 1934:—

Bitter Varieties:—Blue Bud, White Stick, Bunch of Keys, Spanish Town, Hanover and Malta Hotel.

Sweet Varieties:—Yellow Belly, George Blade.

Paw-paws.—Fourteen strains were planted for the Geneticist for breeding purposes, but most of them developed Mosaic Disease and had to be destroyed.

Cover Crops.—The following were again planted through the banana plots:—*Centrosema pubescens, Crotalaria anagyroides, Crotalaria usaramoensis, Tephrosia candida, Tephrosia vogelii.* Seeds of the above were forwarded to the Experiment Station at Grove Place for trial.

Centrosema pubescens, owing to its wiry climbing habit which is a disadvantage, is not considered a suitable cover for planting through banana fields.

Crotalaria anagyroides, Tephrosia candida and *Tephrosia vogelii* did not thrive under the heavy shade of the banana trees. The former grew poorly and did not branch while the latter did not produce flowers until the plants were dying and the seeds did not mature.

Crotalaria usaramoensis has shown promise of doing well both under shade and between the rows of citrus in the lowlands. Seeds of this have been collected for further plantings and distribution.

The Soya Bean (*Glycine Max*) which was received from Kew last year was planted both under shade and in the open. It grew remarkably well and covered the ground about a foot deep without climbing the banana trees. Unfortunately, during the heavy rains the plot was covered with flood water on two occasions and this before the pods matured, thus most of the seeds rotted before maturing. A few seeds were collected and these will be planted out in the Citrus Grove. From its thick growth and non-climbing habit it appears that this variety of Soya Bean may be useful for growing through banana fields on sloping land to assist in preventing erosion during heavy rains.

Diseases.—Mosaic Disease was not prevalent in the station except on the varieties S.C. 12/4 and B. 891. Although these varieties were persistently rogued, infection was continually showing up and they were dug out and the plots replanted with healthy cuttings of the same varieties. There appears to be some grass in the station which keeps up the infection in the susceptible varieties of cane.

Insect Pests.—The Moth Borer was not much in evidence this year, the P.O.J. 2725 being the variety most attacked.

The Banana Borer (*Cosmopolites sordidus*) was seldom found in the Banana Plot.

The Citrus Black Fly was kept in check by the 'Eddie Wasp' (*Eretmocerus serius* Silv.)

Agricultural Education.—The students of the Farm School visited the Experiment Station for five days each week where they received instruction in nursery work, the budding of citrus, etc. They carried out experiments in the School Garden with various vegetable crops and received instruction in the growing and cultivation of these crops.

M. S. Goodman,
Superintendent.

Report of the Superintendent of Sugar-Cane Experiments.

Weather.—After the hurricane of November, 1932, there was a very dry period until the end of May, 1933. This provided an ideal reaping season and the sugar-cane crop was harvested in record time. Canes planted in November and December suffered badly from the prolonged drought and in many cases, although repeated supplying was done during the reaping when tops were available, it was not until June when the rains set in that planters were able to establish their fields. This resulted in a very irregular stand of canes in the field and may affect the juice when the canes are reaped. A difficulty faced the planter at the end of the reaping season in May, which he was not equipped to meet, in the form of obtaining tops for supplying his unestablished fields. Some of the small factories delayed reaping for a few weeks so that they would have planting material, with the hope that rains would soon come. Others had to send long distances to obtain planting material from those estates that had not finished reaping, while others had to resort to inferior planting material which should not have been used. This difficulty would have been solved if planters had small nurseries of the varieties which they intended planting.

On October 28th and 29th a hurricane passed over a portion of the southern, western and northern parts of the Island doing a fair amount of damage. The Microbiologist and the writer made a tour of the parishes damaged by the hurricane and reported thereon. Owing to the roads to several of the estates being either blocked or under water it was impossible to visit them. The tour lasted five days and during that time approximately 500 miles were covered but owing to the short time at our disposal and the large area covered it was impossible to make a thorough investigation of the damage.

The plant canes at that time of the year were well advanced in growth and could not stand up to the high winds as well as the ratoons which were not so advanced in growth. The leaves of the ratoon canes were stripped to the midrib but the plant canes were blown down and the leaves also badly damaged. A couple of weeks after the hurricane the majority of the canes that were not broken or otherwise damaged had come up again and showed signs of a speedy recovery and new development of leaf growth.

In some places the flood water resulting from the hurricane covered cane fields for weeks and this has done more damage than the high winds. In other places the rivers in flood not only covered large cane areas but deposited large quantities of debris through the cane fields burying the canes. In most cases these have rotted owing to the difficulty of getting through the canes of advanced growth to clear them. Some of the rivers carried away large portions of cane fields and now have their courses where canes formerly grew luxuriantly.

After the hurricane rains fell continuously to the end of the year and side shoots have developed to a large extent. This will affect the sucrose in the juice at reaping.

Varieties.—The B.H. 10(12) is still considered the best variety in the Island for tonnage, milling, juice and ratooning quality on those lands suitable for its growth and development. On the rich, deep, alluvial soils to be found in most of the sugar-cane growing area this variety, so far, has not yet been displaced by any other variety except in areas where Mosaic Disease is prevalent.

The P.O.J. varieties 2878, 2727 and 2725 are fast replacing the Uba where mosaic is prevalent, these varieties being easier to reap, handle and mill than the Uba and also being commercially immune to mosaic.

P.O.J. 2878 has so far given fair tonnages in small areas but in 1934 there will be a larger acreage of this variety to be reaped. This variety has now been planted over a large area and in various types of soil so that some definite conclusions can be arrived at in the near future.

P.O.J. 2727 has, on a small scale, shown promise of giving better results on the poor soils than the West Indian varieties. The juice on these lands is as good as the old White Transparent. This cane has also been extended on the poorer lands.

P.O.J. 2725. The planting of this variety has been discontinued by many planters on the better lands owing to its poor ratooning, except where mosaic is prevalent. A very undesirable quality in this variety is its early tasselling particularly in ratoons.

E.K. 28. This variety is planted extensively only on the alluvial soils in the Vere district and gives large tonnages and good juice. Apparently, from the few trials made with it on the heavy clay soils it gave poor results and planters too hurriedly came to the conclusion that it was not a suitable variety and discarded it from their collection, but it is hoped to give this variety further and more extensive trials under various soil and climatic conditions.

Ba. 11569 and S.C. 12/4 continue to give good results on those estates where they are planted. The S.C. 12/4 gives heavy tonnages as plant canes but has the bad quality of dying out in ratoons, particularly in the clay soils, and has to be supplied with other varieties which ripen at a different period, thus affecting the sucrose.

Trials are now being made with the B. 891 and B. 726, new introductions from Barbados.

Manurial and Other Experiments.—Experiments were reaped at the following places:—Morelands, Innswood, Georgia, Swanswick, Llandovery and Kew, one experiment each; Hampden, Richmond and Worthy Park, two experiments each. The results of these will be given in the report of the Agricultural Chemist.

Manurial Experiments were laid down on the following estates during the year:—Morelands, Georgia, Duckenfield, Llandovery, Richmond, Long Pond, Swanswick, one experiment each; Hampden, two experiments.

Cultivation.—It is pleasing to report that planters on a whole are taking much more interest in the cultivation of their fields than heretofore, but there is a lot more to be done before it can be said they have reached anything like perfection in their methods of cultivation.

There are now in the island two Gyrotillers which are doing first class work. These machines plough, pulverise and furrow the land at the same operation and at a considerably lower cost than any other mechanical or animal form of cultivation. There are other large areas under sugar-cane where the Gyrotiller could be used to greater advantage. This would not only improve the soil but increase the tonnage of cane.

Extensions.—During the year large areas were put into cane in St. Catherine. Most of this area was in cane some years ago. In Vere the area under cane has also been increased.

Owing to an increase in the cane area last year and good seasons it is estimated that the 1934 output of sugar will be much larger than this year and may exceed all previous records.

Diseases.—Mosaic Disease, although prevalent in ratoon fields in some districts, is steadily decreasing. This is due to the extensive planting of the improved Java varieties which are commercially immune to this disease. Some of the estates which were so badly infected with this disease that only Uba could be planted, are now, after several years, replanting their fields with the P.O.J. and West Indian varieties with very little infection appearing on the suceptible varieties.

Root Disease has appeared to a serious extent on some estates. Liming and better drainage have been resorted to, also the planting of varieties that are resistant to this disease. Unfortunately, this disease is encouraged by the running of very old ratoons and the planting of old ratoon material which is diseased.

Eye Spot was very prevalent on some estates but lasted for only a short period as when conditions improved the canes soon threw it off.

Insect Pests.—The Moth Borer was very noticeable on a few estates, chiefly on the P.O.J. 2725, but on the whole it cannot be said that much loss is caused by it in Jamaica. So far, no parasites have been observed in the egg batches and it would be advisable, before this insect increases to dimensions where it will be a serious pest, that parasites be imported and liberated.

Visits.—Periodical visits were made to the sugar estates during the year. Planters look forward to these visits when the merits of the varieties grown by them on their different soils are discussed and information is given with regard to the results obtained from varieties grown on other estates similar in soil and climate. These visits have been of great benefit both to the planters and to the Department. Special visits have also been made at the request of planters to investigate various troubles that occurred to them and the necessary advice given in the matter.

Planters, when in Kingston, also visit the office to discuss matters of interest to them but which do not necessitate a special visit of investigation to the estate.

M. S. Goodman,
Superintendent of Sugar-cane Experiments.

Government Laboratory,
Hope, Kingston.
15th February, 1934.

Report of the Superintendent of Agriculture.

1. I have the honour to submit this my Annual Report for 1933.

2. Experiments on Economic Crops.

In co-operation with the Agricultural Chemist, I supervised the laying-out and reaping of manurial experiments on sugar cane and bananas. The results and details of these experiments will be dealt with in the reports of the Agricultural Chemist.

3. Agricultural Surveys.

An Agricultural Survey of the irrigation possibilities of certain areas of the Liguanea was undertaken and a report was submitted to the Director.

In conjunction with this survey an investigation of the composition of the waters furnished by the wells in the area was made.

I carried out Agricultural Surveys on two routes along which it was proposed to construct main roads.

4. During the absence of Mr. Howe in the U.S.A., I acted as Farm Superintendent at the Hope Stock Farm, in addition to my ordinary duties.

5. In May I carried out a survey of the Banana Borer infection in the Western Area in conjunction with the Entomologist.

6. In compliance with the instructions issued on my taking over this office, I have had my headquarters in the Laboratory of the Agricultural Chemist, and when not engaged in other duties I have assisted in the analyses of the Laboratory. This phase of my work will be dealt with in the Report of the Agricultural Chemist.

R. S. Martinez,
Superintendent of Agriculture.

IV. DISEASES OF ANIMALS AND PLANTS.

Report of Government Veterinary Surgeon.

Introduction.—From 1st January to 1st February, 1933, I served in the capacity of Acting Director of Agriculture and was succeeded by the Government Microbiologist, Mr. F. E. V. Smith, as from 2nd February.

Vacation leave of one month was granted me on a medical certificate on February 2nd by the Governor and I resumed my substantive duties on March 2nd for one month only, because my health again broke down and necessitated vacation leave of seven months (one in the Island and six in England).

During the ten months of the year ending Nov.ember 2nd, with the exception of March, Dr. Vincent Tavares of Kingston, filled my office in an acting capacity.

Returning from England on October 30th, I resumed my duties in the Department on November 3rd.

I wish to record the kind consideration show me during my illness by His Excellency, the Governor, and the encouragement and assistance extended to me by Mr. F. A. Stockdale of the Colonial Office, whilst I was in England.

General Observations.

1. The year 1933 stands out in the history of the Island as one of extremest weather conditions. Following the hurricane of early November, 1932, with its general wind and rain devastation throughout the Island, but chiefly in its western portion, a protracted drought of six to eight months in various parts of the Island ensued, which seriously retarded the recovery of plantations and caused much hardship and loss among the livestock by reason of shortage of water and impaired grazing. The adverse conditions in the early part of the year in combination with a definite tendency within recent years towards an accumulating surplus of cattle and no foreign market as an outlet, intensified the business depression in livestock generally throughout the Island. The depression has affected the beef-producers more acutely than those engaged in dairying, for the surplus is confined mainly to the lower class type beef cattle. The dairymen, however, had their share of discouragement in that, though the market for milk generally is good in periods of drought, the yield of their cattle is very materially reduced during continued drought. After the drought feeding conditions improved, but the incessant rains were a hardship on the stock and in many cases the dairymen were no better off financially than during the drought.

2. The few dairies engaged in the production of fresh butter have had to contend with falling local prices by reason of increasing importations of low-priced creamery butter of high quality, chiefly from Canada, New Zealand and the Irish Free State.

3. Local production of fresh meat, including poultry, has also experienced increasing competition by importations mainly from the United Kingdom, Canada and New Zealand. The total of such products in 1932 was 28,845 lbs. while in 1933 it rose to 87,443 lbs.

The imported meats generally are higher in price than the native article and apparently find a select market in the Island because of their better quality.

4. A small foreign trade in mules has developed in the last three years (100 in each of the years 1931 and 1933 going to plantations in the Republic of Panama and a trial lot of 50 in 1932 to Spanish Honduras). An increase of this foreign trade, coupled with the local demand of the Public Works Department and the banana and sugar plantations, would soon bring about a revival of mule-breeding in the Island.

5. Baby chicks. Small experimental importations of pure-bred baby chicks (Rhode Island Reds and Leghorns mainly) chiefly from Miami, Florida, U.S.A., were made in the latter eight months of 1932 by aeroplane transportation. These proved so satisfactory that in 1933 the number so imported increased to 2,883. As the general type of domestic poultry in the Island is poor and of low-egg production, the introduction of pure-bred birds by this means in large numbers from high class hatcheries is certain to have very beneficial results.

Government Farm School at Hope.

During the three months (March, November, December), when not on vacation leave or acting as Director of Agriculture, I gave lectures and demonstrations in veterinary science as scheduled in the School's Prospectus to the three classes of students, and whenever circumstances permitted, augmented the demonstrational feature of the work by utilizing clinical cases at the Farm, and nearby properties.

In my absence Dr. Vincent Tavares, as Acting Government Veterinary Surgeon, performed these duties. His regular attendance at the School was frequently prevented by urgent official visits to country parts in connection with the investigation and surveillance necessary in respect of actual outbreaks or suspected occurrences of notifiable diseases under Law 29 of 1922.

Government Stock Farm at Hope.

In many respects the livestock at the Farm had a hard time in 1933. A long drought of seven months, commencing after the early November hurricane of 1932, soon parched and obliterated their grazing. This period was succeeded by seven months of continuous rain of unprecedented precipitation for the locality, especially from the early part of June to the end of October. Though grass was then abundant, the continuous rain adversely affected the vigour and milk yield of the dairy animals.

Fodder was furnished throughout the droughty months by sugar cane (chiefly Uba), which maintained the herd successfully along with concentrates until the latter part of April, when the stored Guinea corn silage was requisitioned twice daily for fodder, until the end of June when pasturage again was available.

The successful maintenance of the herd, numbering approximately 290 head, including calves, through this protracted drought (Hope Farm is normally a very dry area from December-April and again from June-August) illustrates once again what can be accomplished in dairying with sugar cane fodder in droughty seasons aside from the more expensive method of ensilage.

The extremes of weather conditions mentioned, adversely affected the general health of the cattle in many ways. The absence of succulent feed in the drought and the debilitating effect of the succeeding wet weather, produced several cases of various forms of gastro-intestinal disorders, particularly among the calves, an abnormal incidence of infected feet among the adult animals, and probably an increased susceptibility in some cases to tick fever.

Tuberculosis.—The annual intradermal tuberculin test of all the cattle then on the Farm (287 head including calves) was made by Dr. Vincent Tavares, June 12th-17th, supplemented by tests of six working steers from Fort George, St. Mary, for admission to the Farm: two steers on June 6th and four on November 1st.

Result of test: all animals negative to the test.

The following table shows the incidence of this disease at the Farm for the seven years, 1927-33 inclusive:—

Month of Test.	Number Tested.	Result.	Percentage Infection.
Jan., 1927	359 head	20 reactors	5.56%
July, 1927	303 head	1 reactor	0.33%
December, 1927 ..	312 head	1 reactor	0.32%
November, 1928 ..	297 head	1 reactor	0.33%
October, 1929 ..	342 head	1 reactor	0.29%
Aug. and Oct., 1930 ..	326 head	No reactors	Nil.
December, 1931 ..	348 head	1 reactor	0.28%
June, 1932	227 head	No reactors	0%
June, 1933	293 head	No reactors	0%

Imported Cattle.—

(i) Only one bull was imported during the year, namely, a Guernsey from Emmadine Farms, New York State; Double Folly, born January 16, 1930: landed December 28th, at a cost of £220.

This animal has taken very kindly to the change of climate and fodder and was in good health and condition at the end of year.

(ii) The following imported bulls passed through the year with general good health and freedom from accident.

1. Montgomery, Sanhiwal Pusa, born July, 1917, landed from India, November 24th, 1920.
2. Red Poll, Newhall Theagenes: born August 23, 1930, landed from England on November 14th, 1932.
3. Holstein-Friesian, Sir Francey Romeo Posch, born December, 1926, and landed from Canada in June, 1930.

(iii) Imported Guernsey bull, Foremost Monogram, born November, 1922 and landed from Emmadine Farms, New York State, on June 17th, 1929. maintained good health and functions until September 26th when he received a deeply penetrating puncture in the heel of the outer claw of the right hind foot, probably from a large nail. The subseuqent infection penetrated the coffin joint and the navicular and sesamoid sheaths. The affected claw was amputated on December 30th and later the sesamoid sheath was drained. Although much improved after 4 months, the animal still shows marked lameness and inflammation of the coronary and fetlock joints.

(iv) Jersey bull, "Sophie 19th's Victor 63rd," born August, 1927: landed from U.S.A., June 17th, 1929, showed continued impotency and lack of all sexual desire during the year.

He died suddenly on December 19th, 1933, from gastro-intestinal obstruction arising from an extensive edema of the pylorus and duodenum.

(v) Red Poll bull, Leona's True Lad; born November, 1924, and landed from Iowa, U.S.A., in February, 1929, was transferred to Grove Place Stud Farm in November, 1932.

Blackleg (Clostridium chauvei)—

No cases of this infectious disease occurred during the year. The annual vaccination with aggressin, as instituted in 1927, was not carried out as usual.

Infectious Bovine Abortion (Bang's Disease)—

As recorded in the History of Hope Farm by former Director, Mr. H. H. Cousins, this disease has existed with a variable annual incidence of abortions in the herd since its establishment in 1910-1911. From his account it appears that the percentage of actual abortions in the herd had reached the vanishing point about 1920, when re-infection resulted from the importation of three Aberdeen-Angus heifers from England.

As all veterinary sanitarians know, this is a very difficult disease to control, even by the strictest isolation of aborting subjects, and their detention in quarantine until all genital discharges cease; because among other things many non-aborting cows may be infective and actual, if not apparent, disseminators of the disease.

Years of study of this many-sided and perplexing problem have shown that the only effective method for its eradication in a herd is by periodic agglutination test of all the cattle in an affected herd, and the removal for slaughter or into absolutely separate premises of all positive reactors to the test—the latter method naturally involves the keeping of two separate herds. On many farms neither procedure is possible and all that can in reality be accomplished is to control gross infection and prevent as far as possible its dissemination by the isolation of abnormal parturient and aborting cows and the employment of other sanitary measures for checking the spread of infection on the farm.

The last-mentioned method is the procedure which has been employed at the Farm for many years and the results, though only partially successful, compare favourably with the record of the same or similar methods in other countries. The problem is being considered from its many angles and any practicable improvements of procedure for its more effective control will be tested.

Parturition and Abortion Record, 1928-33.

Year.	Full Time Births.	Still Births.	Abortions.
1928 ..	94	2	5
1929 ..	81	2	8
1930 ..	118	4	4
1931 ..	126	..	9
1932 ..	127	1	9
1933 ..	144	4	7

Tick Fever (Piroplasmosis bigeminum)

Although 'dipping' for tick control was systematically done throughout the year, two outbreaks of tick fever occurred—one in late October (October 26) and the other in early December (December 4th).

Investigations showed the affected animals individually free from visible tick infestation (adults, nymphs, larvae) but in both instances the stricken cattle belonged to a group which was pastured on land adjoining (separated by a wire fence only) a field grazed by irregularly "dipped" cattle belonging to a neighbouring party. Such incidents connected with the care of the cattle at the Farm are unavoidable by reason of the location of the grazing lands of the Farm and the public and semi-public roads which intersect its lands.

In the two outbreaks, 21 cattle were involved, 7 acutely, 14 mildly. By the timely use of trypan blue all recovered, except two heifers, which died within three days after the initial fever.

Mastitis.—The number of cases decreased during the year. Affected cows are kept as a stable group by themselves and precautions taken to prevent the transfer of infection.

Animals affected: 1 Quaggle 2. Matilda 13th, 3. Wye 3rd.

Gastro-Intestinal Diseases.—

As already indicated, the drought and subsequent excessive rainy weather predisposed the cattle of all ages to digestive troubles. Generally the adult cases suffered from coarse vegetable fibre impaction and the pail-reared calves from catarrhal, etc., disorders of the intestines with the exception of some cases of impaction in calves fed chopped cane at too early an age. In addition to many cases (few in adults, numerous in calves) which with treatment recovered, three cows (Shrew 13th, Loretta A, Partridge) and seven calves died.

Fouls of the Feet (Bacillus necrophorus (?)).

During the wet weather much trouble and extra work were caused by the unusually large numbers of infected feet among the dairy cattle.

Affections of the feet and joints.

13 cases of severe interdigital infection (fouls)

7 cases of foot injuries, etc., from staples, nails, etc.

4 cases of rheumatic-like affections of the joints.

No casualties from these causes.

Other additional Diseases or Affections.—

Minor injuries as from stakes, wire cuts, etc.	20 cases
Sores of the vulva	10 "
Eversion of the uterus (partial or complete)	2 "
Eversion of the rectum	1 "
Bloody diarrhoea	3 "
Dislocations and fractures	2 "
Retention of foetal membranes	13 "
	51 cases

Summarized Death List—

Impaction of 3rd stomach	2 cows: Loretta A, Partridge
Acute indigestion	1 cow: Shrew 13th
Gastro-Intestinal Obstruction	1 bull: Imported Jersey, Victor
Fractures from accidents (animals killed)	2 cows: Lydite 4th, Jess
Tick Fever	2 heifers: Glenstine (Jersey), True Star (Red Poll)
Dystokia	1 cow: Marcella
Gastro-intestinal disorders of calves	7 calves
Killed as weakling calves	2 calves
Crushed by dam	1 calf
Septic pneumonia	1 cow: Villanelle
Unknown causes	2 heifers: Mabel, Cowslip's calf
	22

Government Stud Farm at Grove Place.

Weather conditions were much the same as at Hope—drought from November, 1932, to May 14th, 1934, followed by continuous rains until the close of the year. As reported by the Superintendent, the rainfall for the year, in spite of the 4½ months of severe drought, was 133.59 inches as against an average of 64.55 inches for the previous five years, or approximately 20.6 inches monthly for 6½ months.

Under such extremes of adverse weather it is not surprising that the health of the livestock suffered and the death rate for the year was high.

Mane Stock.—

(i) Stallion, "Snow Boy," kept well under stable conditions and has steadily improved in every way since his arrival at Grove Place in early 1932.

(ii) Imported jack, Kentucky Boy, now 18 years of age, rendered satisfactory service at the Stud in spite of his age. He should certainly be superannuated in 1934.

(iii) The other farm mane stock consisting of 8 mares, 1 four-year horse, 2 fillies, 4 colts, 8 young mules of various ages and 5 working mules, 2 young native jacks, 5 jennies, passed through the year successfully except jenny, Dew Drop—died March 26th, of general emaciation.

Recurrent cases of psoroptic mange were treated with lime-sulphur wash with beneficial results. This form of parasitic infection is so common in the Island that visiting mares frequently arrive at the Farm in a more or less infected state, contrary to the rigid instructions issued to prospective patrons.

Cattle.—

(i) The stud bulls maintained in 1933 were:—

1. Etta's Pogis—native Jersey.
2. Glen's Prefect—native Jersey.
3. Glen Fontaine's Lad—imported Jersey.
4. Cortes—Montgomery-Guernsey.
5. Justice—Montgomery-Brown Swiss.
6. Leona's True Lad—imported Red Poll.

All these were successfully carried through, except that Glen Fontaine's Lad (imported in May, 1927, as a 5 year old) due to progressive emaciation and sexual impotence was superannuated and destroyed on August 30th.

(ii) Of the other Farm cattle numbering 170-180 head including calves, the following died or were destroyed.

(a) Five cows and one heifer: two subsequent to eversion of the uterus, two from progressive emaciation, one from dystokia, one from dislocation of the hip, ... 6 head

(b) Seven calves: 2 from suspected blackleg, 2 from general emaciation, two from injuries to their limbs, one from interdigital infection 7 head

Total inclusive of Bull, "Glen" .. .. .. 14 head

Sheep and Goats.—

Sheep.—Stud Suffolk Ram, "Tendring Token," landed November, 1932, from Essex, England, suffered from pneumonia in the summer storms, but recovered and has been in active service since to visiting ewes. The Farm owns no ewes at present.

Goats.—In spite of adequate housing and care, all the Toggenburg goats imported from England in November, 1932, and their six progeny died of pneumonia and enteritis during the worst of the stormy weather, namely in August, September and October.

The extremely unfavourable weather conditions also caused considerable mortality among the native goats of the surrounding districts. Generally goats do best in Jamaica on the sea coast, but due to the persistent representations of the Jamaica Agricultural Society, the Director, Mr. H. H. Cousins, decided in early 1932, to give these animals a trial as a small flock and for stud purposes at Grove Place.

The experience so gained indicates definitely that the climate of Grove Place is unsuited to these small stock, at least, to the imported animals.

Another attempt is to be made with this goat project in a modified form. The nucleus of the herd (one buck and three doses of Toggenburgs) is to be imported from the southern part of the U.S.A. and kept at Hope where the buck will also be used for stud purposes. A second buck of the same breed is to be stationed at Grove Place for stud purposes and to head an initial flock of six native ewes.

The need for improving the goats of the peasants is urgent and imperative.

Death list of goats.

1. Importations from England costing landed £103.
   Buck, Stockwell Callum.
   Does, Sahara of Weald.
   Riding Cordelia.
   Widdington Wilhelmina.
2. Native-born progeny.
   3 buck kids,
   3 doe kids.
   Total 10 head.

Fortunately the buck served 43 visiting does during the year before his death on October 23rd.

Swine.—The Berkshires imported from England, July 22nd, 1932 were:—

One boar, "Ritchings Bon Accord."

Two in-pig gilts: Ridgemoor Mistress, Ridgemoor Prolific ii.

These with their five unsold or reserved progeny kept good health through the year.

A native-born purebred boar, "Grove Marquis," by Syerston Duke out of Ridgemoor Prolific ii has been added to the swine stud list. Twenty-four visiting sows, chiefly from nearby districts, were served during the year.

Deaths.—3 pigs (1 boar, 2 shotes of Ridgemoor Mistress) from sour feed.

Tuberculosis of Cattle.—

Triennial intradermal tuberculin tests have been conducted on the farm cattle since 1924 as below.

So far no positive reactors have been found at Grove Place, although the herd is more or less exposed by the admission and temporary sojourn of visiting cows from all parts of the Island sent to the stud bulls.

Tuberculin Test Record (Adults and Calves)

Date	Number Tested.	Result.
November, 1924	214	All negative.
April, 1927	420	"
July, 1930	162	"
July, 1933 ..	150	"

Blackleg.—There is evidence that the soil at Grove Place is infected with the organism of this disease (Clostridium chauvei.). Consequently annual vaccination has been practised for several years as a preventive measure.

On April 26th, prior to the performance of annual vaccination, one cow calf (Trixy), not previously vaccinated, died with symptoms of blackleg. Accordingly the annual vaccination with Aggressin was rushed, and on May 8th, 18 heifers, 16 calves were treated.

On September 12th, Mildred's cow calf died with symptoms of blackleg. This animal along with other calves born subsequent to the May vaccination, were thereupon vaccinated and no further mortality occurred for the rest of the year.

Number vaccinated. .. 34 head on May 8th
9 head on September 18th.—
Total 43 head.

Diseases under "The Contagious Diseases Animals' (Inland) Law of 1922, *Law* 29 *of* 1922.

All reports and rumours regarding outbreaks of these notifiable diseases received by the Department during the year were promptly investigated and dealt with as prescribed by the Law.

Only three of the listed diseases, namely, Foot-and-Mouth Disease, Anthrax and Swine Fever (Hog Cholera) required serious attention as shown below:—

Foot and Mouth Disease.—Three suspected occurrences were reported:—

(i) At Spanish Town Slaughter House on March 24th, where a bullock immediately after arrival was noticed to have small sores on the edges of the lips, the dental pad and hard palate.

The sores, upon veterinary examination, were really superficial abrasions frequently exhibited by cattle grazing on very coarse or thorny forage plants. No ulcers at all characteristic of foot-and-mouth were found, the tongue and feet were free of lesions and the group of cattle from which the bullock was drafted were entirely free of all symptoms of the suspected disease.

(ii) At Charlemont, St. Catherine, on March 29th, a grade Devon bull was suspected. He proved to be an acute case of an eruptive (oedematous and purulent) condition of the lips and feet below the knees and hocks frequently observed in the Island when some cattle feed too liberally on guango pods (Pithecolobium samani). Nearly every year cases of this kind are reported as suspects of foot-and-mouth. In districts where the condition is well known it is generally called "gaungo farcy."

(iii) Hughenden Farm, Red Hills Road, St. Andrew.

In this instance the suspected steer was found affected merely with a maggot-infested sore of one foot and none of his associates, 4 cows, 3 steers, 3 heifers, showed any indications of specific infection.

It is a pleasure to record once again that there have been no recurrences of this serious disease since the latter part of August, 1926, when the last cases connected with the Midgham (Charlottenburgh) Outbreak were disposed of under Slaughter Orders.

Anthrax.—The incidence of this disease was somewhat higher in 1933 than for many years. This may in part be assigned to the unusual weather conditions of the year.

Infection was definitely established by field and bacteriological investigations at:—

Property.	Parish.	Approx. Date.
1. Malvern Park	St. Ann	January 20th
2. Tredegar Park	St. Catherine	March 29th
3. Beecham Estate	Clarendon	July 12th
4. Retreat	St. Andrew	July 12th
5. Brighton District	St. Elizabeth	July 24th
6. Teak Pen (Chapelton)	Clarendon	July 31st

In all these six outbreaks the affected properties were declared to be "Infected Places" and quarantined in accrodance with the Rules governing Anthrax made under the Law.

In addition to the above "Infected Places," the Spanish Town Slaughter House and its adjoining yards was by Order declared a "Suspected Place" under the Law on 3rd April, 1933, by reason of the admission for inspection of a carcass of a sick heifer killed on Tredegar Park, where shortly thereafte Anthrax infection among its cattle was established.

Circumstances indicative or suggestive of anthrax were also investigated at the following places with negative findings for anthrax.

Place.	Parish.	Date.	Result.
1. Verdun Pen	St. Mary	February 5th	Blackleg
2. Russell Hall	St. Mary	February 7th	Blackleg.
3. Holland Estate	Trelawny	March 3rd	No definite diagnosis
4. Hartlands	St. Catherine	July 23rd	No definite diagnosis
5. Amity Hall	St. Thomas	July 24th	Urechites poisoning (?)
6. Enfield Farm near Linstead	St. Catherine	October 9th	No definite diagnosis
7. Bog Estate (Vere)	Clarendon	October 13th October 27th	Urechites poisoning

In view of the circumstances disclosed at the time of the preliminary investigations of these cases, a Provisional Order of Quarantine was imposed as a precautionary measure for variable periods of time on Hartlands, Amity Hall, Enfield Farm and Bog Estate. In the other cases the conditions did not warrant such restrictive action. On all the "declared places" prompt vaccination of contacts and exposed animals. cremation of carcasses *in toto* and restricted movements of the stock successfully confined the outbreaks to their initial foci.

Swine Fever (Hog Cholera)—

Only one suspected outbreak occurred during the year, namely, at Mr. Legman's property on Lilford Lane, St. Andrew. Ten hogs died suddenly on August 4th and the autopsy disclosed lesions strongly suggestive of swine fever. The premises were placed under provisional quarantine and regular inspections made of the contacts, but no further cases developed sickness or died up to the 25th August, when the quarantine was revoked. It is more than likely that the condition was a genuine case of garbage poisoning and not a disease arising from the filterable virus of swine fever.

Non-Notifiable Infectious Diseases.

It is the general policy of the Department to investigate and assist stock owners as much as possible in the control of all communicable diseases; but in view of its very limited veterinary staff much needed assistance has frequently to be refused or be merely of an advisory nature. It is unfortunate that this state of affairs should continue year after year and purely for financial reasons, because there is every evidence that stock owners are anxious to learn and adopt practical methods for the eradication or control of the diseases to which their stock are exposed. In such matters experience has shown that effective suppressive work can be accomplished only by Government control and the intelligent co-operation and support of the livestock interests, large and small. The increasing depression of the local livestock market, it is hoped, may stimulate thought and effort for the general improvement of the livestock of the Island and the provision of more adequate scientific assistance in dealing with the disease problems of the industry.

1. *Tuberculosis.*—No general survey of the incidence of this infection has as yet been possible. Aside from the annual tuberculin tests of the Government stock at Hope and Grove Place, no tests were made by the Department during the year.

Occasionally tissue specimens sent to the Department for examination show tuberculous infection, and in this way reveal isolated foci of infection in widely separated portions of the Island. No follow-up investigation of the foci so uncovered has as yet been attempted officially, except in cases where owners have personally requested the assistance of the Department.

A few large operators through their own veterinary service have taken preliminary steps to ascertain the status of their herds in respect of this disease. As the disease is at present not notifiable under the Law, no official figures of its percentage incidence are available, but, if the statements contained in the news columns of the local press are reliable, the percentage in some herds in decidedly high.

Additional information on this subject is gradually being furnished by the returns of tuberculosis-affected butcher's stock slaughtered at the Kingston abattoir. These indicate definitely that in some cases the fat stock supplied to the Kingston market are 3% tuberculous. This figure probably is not a true index of the real state of some of the incriminated herds, for only the best stock generally come forward for the Kingston market.

On the other hand, tuberculin testing under the Milk and Dairy Regulations of the Kingston and St. Andrew Corporation by the Corporation's veterinarian on about 2,000 head of dairy cattle supplying. Kingston and its vicinity, fortunately shows a very small percentage incidence of disease, namely 0.11%

Blackleg.—Sporadic outbreaks still continue in many places in the Island as in the past. The disease is more frequent in the moist elevated valley lands than on the coast plains. Vaccination for prevention or supperession of outbreaks is now so widely known and practised that the aggregate annual loss from this disease tends to decrease. The Instructors of the Jamaica Agricultural Society are trained and equipped to vaccinate for small landowners in affected districts and by so doing are further popularizing this effective means of its control.

Tick Fever (Piroplasmosis bigeminum)—

No extensive outbreaks of this disease came to the knowledge of the Department during the year. Excluding the two occurrences at the Hope Farm in the last quarter of the year, only two sporadic outbreaks were referred to the Department: (i) Grierfield, St. Ann, (ii) Belle Vue, St. Ann, in both cases the incidence was very small and affected animals recovered. This, however, probably does not fully represent the incidence of this disease, because as in past years it occasionally appears acutely in a small number of cases (apparently attacking only the most susceptible members) and then subsides spontaneously or with the aid of more systematic dipping.

Haematuria vesicalis.—

The Department was not called to deal with any outbreaks of this nature during the year. Cases are known to have appeared intermittently in Southern Manchester, the district in which the disease was first studied in October, 1923. Intravenous injections of tartar emetic are still being used by a few persons as a palliative measure. No absolutely curative medicinal treatment has been established. Transfer of affected cases in the earliest stages of the disease to the coastal plains arrests the process.

The beneficial effects of such transfer involving a change of climate, fodder, water and other environmental factors have frequently been noted but not satisfactorily explained.

The disease appears to be identical with haematuria vesicalis reported in various countries of Europe, British Columbia, India and parts of Australia. Its etiology has not yet been clearly established.

Parasistic worms of the Lungs and Stomach of Cattle.—

These are the two chief parastitic maladies which are frequently encountered in requested investigations of the lack of thrift in young cattle. They are more common and acute in the elevated valleys and wetter portions of the littoral, but in reality are ubiquitous:—the incidence naturally varying with climatic, soil, water and fodder conditions.

It is rare that any systematic medicinal treatment by owners can be obtained. In most cases things are permitted to take their natural course, except that in most cases the benefit of good feeding and frequent change of pastures is realized and practised. As the treatment involves intra-tracheal injections and drenching operations –both requiring considerable care in execution– it is not surprising that generally speaking, owners figure that the necessary supervision, added labour costs and risks involved, preclude the adoption of remedial measures. These affections of such injurious effects to young livestock have been been so long existent in the Island that it is very difficult to arouse a definite interest in their suppression.

The situation is analogous to tick control. Demonstration of efficient methods of control and their resultant economic benefits are necessary to convince stock-owners of what may be accomplished by concerted and systematic action.

Tick Control.

(i) No systematic inspection of dipping tanks and cattle was undertaken during the year. Inspections incidental to visits to cattle properties for other specific purposes are made when possible. This branch of veterinary work is too large and time-consuming for a single officer with other duties to perform.

(ii) The sales of Paranaph and Arsenite of Soda—the latter only to owners of registered dipping tanks—as below, indicate that, without compulsion, dipping of cattle continues as in the past to make its own appeal.

Sales of Paranaph and Arsenite of Soda from the Government Laboratory.

Lbs.	1927.	1928.	1929.	1930.	1931.	1932.	1933.
Paranaph	29,954	37,353	37,849	33,572	36,770	34,965	39,850
Sodium Arsenite	17,475	21,900	21,725	20,175	25,499	22,021	24,818

(iii) Number of Registered Dipping Tanks.

1928.	1929.	1930.	1931.	1932.	1933.
305	329	341	351	362	368

Several of these are known by casual inspection to be in such bad order that they cannot be efficiently operated.

Inspection of Imported and Exported Animals.

1. *Importations*—Landing permits under Law 24 of 1890, etc. were given after inspection for:—
   - 16 Racehorses from England.
   - 2 Saddle horses from England.
   - 1 Devon bull from England.
   - 1 Guernsey bull from U.S.A.
   - 2 Sheep (Suffolk and South Down Rams) from England.
   - 2 Swine (Essex boars) from England.
   - 1 Donkey from England.
   - 16 Dogs from England.
   - 1 Cat from England.
   - 21 Circus Animals (Dunbar and Schweyer Circus) from Cristobal, Canal Zone, viz.: 7 lions, 1 tiger, 1 panther, 1 elephant, 2 camels, 2 chimpanzees, 7 monkeys. (March 31st, 1933).

2. *Exportations.*—No official export certificates of veterinary inspection were given.

Diseases of Bees under The Protection from Diseases (Bees) Law, 1918.

No outbreaks of the diseases listed under this Law were reported or dealt with during the year.

American foulbrood appearing first in 1918, in and immediately around Kingston, was eradicated promptly by incineration of all infected and exposed apiaries within 3 miles of the Kingston Parish Church.

The second occurrence (origin not satisfactorily explained) in July, 1926, was eradicated by quarantine restrictions and destruction of all infected colonies and in toto destruction of all apiaries in which initial infection was not effectively checked by burning of primarily affected colonies.

Since March 31st, 1928—end of 18 month quarantine period in respect of the 1926 outbreak—no further recurrence of the disease has been reported or discovered.

S. Lockett, V.M.D.,
Govt. Veterinary Surgeon,
April 13, 1934.

Advisory Committee on the Banana and Citurs Industries.

Report of the Secretary for 1933.

During the year under review Government decided to replace the Advisory Committee on the Banana Industry by a larger Committee which included Citrus planters in its membership. This action resulted from the wider scope of the Committee's work arising from the Banana Varieties Citrus-Nursery Scheme, adopted during the previous year for the reclamation of land lost from Panama Disease of Bananas.

2. The membership of the New Committee included that of the previous Committee with two additions viz.:—

Chairman:—Director of Agriculture
Secretary:—Government Microbiologist.
Members:—

Hon. J. H. McPhail	Hon. T. J. Cawley
Hon. K. V. Abendana	F. A. Cory, Esq.
G. J. Goble, Esq.	G. G. R. Sharp, Esq.
P. Lindo, Esq.	M. O. V. Ffrench-Mullen, Esq.
G. A. Hawkins, Esq.	H. Braham, Esq.

* G. Baxter, Esq. (Secretary Jamaica Agricultural Society).

3. Three meetings of the former Banana Advisory Committee were held during the year, and one meeting of the New Committee. Dr. S. Lockett acted as Chairman for one meeting, and Mr. F. E. V. Smith for two meetings. Mr. W. H. Edwards acted as Secretary for two meetings.

The following members obtained leave during the year:—Hon J. H. McPhail, Hon. T. J. Cawley, Hon. K. V. Abendana, Messrs. F. A. Cory, G. A. Hawkins, G. J. Goble, P. Lindo, and M. O. V. Ffrench-Mullen.

The Supervising Inspector of Plant Diseases attended all the Meetings. The Entomologist and Geneticist attended meetings when required.

4. As usual a large proportion of the routine business of the Committee was carried on by circulated papers, 58 of which were issued during the year.

5. The Committee advised on the working of the Citrus-nursery Banana Varieties Scheme, which was passed by the Legislative Council on its recommendations. Details of the work accomplished under this scheme are given elsewhere.

6. The Committee met Dr. J. G. Myers, Entomologist of the Imperial Entomological Institute and discussed with him the possibilities of the control of Banana Borer (Cosmopolities sordidus) by means of insect parasites, and recommendations were made to Government on this subject.

7. The method of treating bananas attacked by Panama Disease was considered by the Committee on several occasions and it was unanimously decided that the treatment provided in the Order should be rigorously enforced.

8. Records of cases of Panama Disease reported and treated by the Department's Officers are appended.

F. E. V. Smith,
Govt. Microbiologist and Secretary,
22nd January, 1934.

Incidence of Panama Disease in parishes other than Portland in 1933.

Parish.	Total Trees.	Total Plots.	New Cases.	Recurrences.
St. Thomas	10,409	7,640	868	6,772
St. Mary ..	83,415	52,796	816	51,980
St. Ann ..	5,221	2,494	225	2,269
Trelawny ..	1,199	378	22	356
St. James ..	16,654	6,097	216	5,881
Hanover ..	540	328	65	263
Westmoreland	1,301	1,116	47	1,069
St. Elizabeth	160	29	19	10
Manchester ..	704	259	44	215
Clarendon ..	8,528	2,563	237	2,326
St. Catherine	12,150	7,457	594	6,863
St. Andrew ..	893	249	53	196
Total for 1933	141,174	81,406	3,206	78,200
Total 1932 ..	121,722	65,495	3,371	62,124
Total 1931 ..	96,213	55,537	3,102	52,435
Total 1930 ..	73,315	42,141	2,670	39,471
Total 1929 ..	36,661	20,641	2,417	18,224
Total 1912 to 1933: (excluding Portland)	512,170	287,513	19,691	267,822

Monthly Totals.

	Total Trees.	Total Plots.	New Cases.	Recurrecnes.
January ..	12,949	7,024	288	6,736
February ..	15,974	8,727	257	8,470
March ..	14,440	8,002	305	7,697
April ..	10,920	6,457	243	6,214
May ..	11,341	6,772	231	6,541
June ..	7,705	4,778	117	4,661
July ..	7,415	4,716	230	4,486
August ..	10,538	6,371	302	6,069
September ..	11,431	6,866	316	6,550
October ..	12,761	7,257	337	6,920
November ..	13,877	7,666	325	7,341
Decemner ..	11,823	6,770	255	6,515

F. E. V. Smith,
Government Microbiologist.

Annual Report of the Government Microbiologist, 1933.

General.

During the period under review the work of the Microbiological Division of the Department was carried on as follows:—January 1st to Feburary 8th, 1933, the Microbiologist acted as Entomologist in addition to his normal duties; from February 2nd to September 16th when the newly appointed Director of Agriculture arrived, the Microbiologist acted as Director of Agriculture; from September 16th to the end of the year the Microbiologist remained in the Head Office of the Department under a special temporary arrangement. The Secretaryship of the West Indies Inter-Colonial Fruit and Vegetable Conference was undertaken by the Microbiologist and this appointment entailed considerable preliminary work before the Conference and the editing and preparation of the Report of the Conference in collaboration with the special Report-Drafting Committee. A mission lasting a little over four weeks to Central America and Florida was undertaken towards the end of the year, for the purpose of investigating the citrus industries of these countries and obtaining budwood for the citurus nursery scheme. During the periods while the

Microbiologist was engaged in duties outside of his office the Entomologist, Mr. W. H. Edwards, D.I.C., F.E.S., acted on his behalf. Mr. Z. Daniels was retained as apprentice-assistant during the year.

2. *Committees, &c.*—A considerable amount of the time of the Microbiologist has been taken up during the year in attending meetings of Committees and Boards. As acting Director of Agriculture, regular monthly meetings of the Board of Management of the Agricultural Society and the Agricultural Produce Board were attended. As Secretary of the Fruit and Vegetable Conference, meetings of the Jamaica Delegation were attended in addition to the sessions of the Conference itself. The regular meetings of the Advisory Committee on the Banana and Citrus Industries were attended and also those meetings of the Advisory Board on the Hope Farm School which took place during the acting appointment. In addition I was appointed to the Banana Industry Aid Board, which entailed two days per week during the first three months of the year.

Plant Diseases—General.

3. Climatic conditions generally throughout the year were abnormal. The hurricane of November, 1932, which damaged bananas and coconuts in the western end of the Island was followed immediately by a drought which lasted in many districts until June. The second half of the year was the wettest period yet recorded for the Colony and storms passed close to the Island on more than one occasion. These peculiar climatic conditions naturally had some influence upon the incidence of disease not only on account of the conditions of high rainfall but, in the case of bananas especially, because the total destruction of trees by wind delayed diagnosis of diseases. The most important feature of the past year's peculiar weather from the plant pathological point of view is, however, the serious effects which will undoubtedly accrue from the perpetual flooding of some of the best of the banana lands by swollen rivers which originate in areas where Panama Disease is already widely distributed. The returns of disease for December already show the beginning of this effect with seriously increasing incidence in the highly valuable lands in the irrigated section of St. Catherine, and the irrigated and river-bank lands in the district of Vere in Clarendon.

4. Climatic conditions have also had a marked effect upon coconut diseases. Bud Rot, which for many years has been an extremely rare disease became conspicuous very soon after the 1932 hurricane, and losses of trees from this disease have been frequent in the West End and far more common than usual in other parts of the Island. Unfortunately there appears to be a good deal of slackness on the part of planters to clean up their coconut trees after a 'blow' and consequential infections of disease arising at points where heart leaves are damaged nearly always result in Bud Rot and the total loss of the tree.

5. The demand for information about plant diseases continues to grow and this especially refers to crops such as citrus and many of the smaller crops which are now being given extra attention. The storage rots of citrus fruit and the troubles incidental to the establishment of young groves have both been the subject of numerous enquiries stimulated no doubt by the new impetus given to the citrus industry as a result of the Departmental scheme for the reclamation of land lost from Panama Disease by the establishment of citrus.

BANANAS.

6. Panama Disease (*Fusarium Oxysporum cubense*). The severe drought coupled with the losses of trees from wind damage were probably responsible to some degree for the relatively small increase in the cases recorded as compared with the previous year. The details of incidence of the disease are given in my report as Secretary of the Advisory Committee but it is interesting to note that the records show an increase of 16½% as compared with 26%, 31%, 100%, and 115% in the years preceding respectively. These percentages represent, of course, the increase on the actual total of the previous year. The smaller increases in recent years can also be partially attributed to the wholesale abandonment of lands which have become no longer profitable for estate cultivation in bananas, consequently it is essential that it should be realised that the annual loss of land from disease is now becoming very much greater each year, that for the past year alone being of the order of 2,000 acres. At this rate of increase it is certain that our export trade will be affected before long not only in quantity but also in quality as the better lands which produce the heavier fruit are rapidly becoming abandoned. The question of the utilisation of these abandoned lands is a constant subject of consideration by planters as well as officials and apart from the Departmental scheme for establishing citrus, it is pleasing to report that quarantine has been released in many cases during the past year for the extension of cane planting not only among small settlers but for large acreages on estates.

7. The Scheme for development of citrus in diseased districts mentioned in the previous report received the approval of the Legislature in 1933, and great progress was made with the nurseries in spite of constant set backs from floods. The field work was placed in the hands of the Supervising Inspector, Mr. Sutherland, who has expended extraordinary energy in bringing the nurseries through the most unfavourable season known in Jamaica for several generations. At the end of the year nearly 15 acres had been planted out with sour orange stocks, representing at leas 100,000 sound plants in one nursery and about 30,000 plants in the second nursery. Budding commenced in November and is progressing steadily. Mr. Sutherland has trained apprentices in these nurseries who have proved themselves to be very efficient budders, the proportion of 'takes' being well over 90% and almost 100% where fresh budwood is used.

8. The thanks of the Department are due to Mr. Bovell and Caymanas Estates, Ltd., for the lease of a considerable acreage of land at pepper corn rental in connection with one nursery and to the Director of Prisons and the Superintendent of the St. Catherine District Prison for the provision of land and labour in establishing the 1.2 acre nursery at Spanish Town. The assistance received in this way will appreciably reduce the cost of production of the budded trees and so indirectly affect the planters who will obtain trees through this scheme.

9. In connection with this Citrus development a visit was paid to Spanish Honduras and Florida during November and December for the purpose of studying citrus varieties and introducing budwood of the most suitable varieties from highly prolific strains. This tour has been reported upon in detail and it is sufficient to say that every opportunity was taken during the tour to obtain information of use to the Department and the Colony in general. It is necessary to acknowledge, however, the generous way in which the officials

of the Standard and United Fruit Companies and the officials of the United States Department of Agriculture and the Florida Experiment Station placed transport and information at my disposal and so made it possible to cover the maximum of ground during a short visit.

10. The West Indies Fruit and Vegetable Conference recommended among other varieties that future developments should include a high proportion of Marsh Grapefruit and Valencia orange. The recommendation of these two varieties can be throroughly supported as a result of the experience gained during the visit to Florida. It was found however that there was nothing to be gained by importing buds of the Marsh Variety as the better strains already in Jamaica suit the climate very well and are no less prolific than those in Florida. Budwood of several good strains of Valencia orange were introduced however and a considerable quantity of the Davis Seedless grapefruit. The latter is giving good results in Florida and has the reputation of being a better fruit for canning than Marsh Seedless. In addition moderate quantities of the following varieties were imported for trial: Hamlin, Temple, Parson Brown, Homosassa, Surprise Navel and Enterprise Seedless Oranges, McCarty, Thompson Pink Grapefruit and numerous Tanglos and other fruit for domestic orchards.

11. The outstanding observation perhaps of the whole tour was the object lesson seen in Central America on the serious losses which can be sustained in a wet tropical district from planting trees 'on the Flat' and budding too close to the ground.

12. The section of the Citrus-Banana Scheme connected with the testing of the varieties already raised by Mr. Sutherland suffered a severe set back in that several acres of plantings were washed out to sea by the abnormal floods. This and some technical complications necessitated the postponment of the erection of the Cold Storage Plant until 1934. Opportunity was taken however to make trial shipments of mangoes in collaboration with the Farm School staff and shipments of the Bombay (Pari) variety to London realised remunerative prices up to the middle of July when there was a rapid fall in price, due no doubt to the exodus of holiday makers and the competition with the domestic 'Soft fruits.'

13. In view of my absence from my substantive office for the majority of the year very little progress was possible with the problems of wastage in bananas and citrus during transport. This very important problem has been taken up again, however, and it is hoped that trial shipments coupled withexperimental work both in Jamaica and during a proposed visit to England in 1934, will make it possible to still further reduce losses in the near future.

14. In concluding this report I desire to record my sincere appreciation of the ready collaboration and assistance I received from all members of the staff during the period while acting as Director.

F. E. V. Smith,
Government Microbiologist.
30.3.34.

Report of the Government Entomologist.

I have the honour to submit hereunder my annual report for the year 1933. It reviews the observation made on the outbreaks of the major insect pests which occurred during the year as well as notes on the miscellaneous activities in the Entomological Division. The period under review extends from the 8th of February when I resumed my duties after three months vacation leave spent in Europe, until the 31st December.

I have during most of that time been also in charge of the Microbiological Division, acting as Government Microbiologist from the day of my return to the island on the 8th of February until September the 16th. I again performed the duties attached to that post, whilst the Microbiologist was abroad on a special mission from the 16th of November to the 17th of December.

In spite of the overwhelming amount of manual and routine work, which, on account of the total absence of trained assistants or even of unskilled labour on the staff of this Division, has to be performed by the Entomologist, I am glad to say that the services of the apprentice to the Microbiological Division having been temporarily secured during the time I acted as Microbiologist, it has thus been possible for me to devote more time to field work and to experiments than can usually be the case.

Having already had the opportunity to call your attention on the state of affairs accruing from lack of assistance in a Division whose services are becoming in greater demand every year, I shall not return on the subject except to express my gratefulness for the sympathetic consideration you have given to the matter and for the recommendation which you have already submitted to the Government on the subject.

Sugar Cane.—The only insect reported as casusing damage to this crop has been the Weevil Borer: Metamasius sericeus, Ohio. Its prevalence in the fields is a result of the hurricanes and strong winds which during the recent past have frequently blown down a large number of sugar canes. The plant has thus been exposed to the attacks of an insect which under normal conditions does not infest healthy canes.

Banana.—Damage done by the Weevil Borer: Cosmopolites sordidus, Germar, has been on the whole much more severe during the year under review than it had been for many years past. This has been due to a combination of causes of which the following are the most important.

1. After the hurricane and strong winds which in many districts blew down a very large number of banana trees or battered them so much that they had to be cut down, sufficient attention was not, and in many cases for financial reasons could not, be given to essential cultural operations aiming at field sanitation. The large amount of plant tissues thus left on the ground has harboured the insect and afforded ideal breeding places for it to multiply in abundance.

2. During the first months of the year, a protracted period of drought not only increased the effects of infestation on plants whose vitality had been reduced, but also created during the winter months which followed the hurricane of 1932, very favourable environmental conditions for the multiplication of the pest in destructive numbers.

3. In localities where the incidence of Panama Disease has been high, fields are being abandoned with banana stools left standing amongst rank vegetabation. The borer has under such conditions found ideal breeding grounds over large areas.

4. The practice of renting lands to tenants and of subsequently giving them notice to quit twelve months in advance, during which period no cultivation is done, has also contributed to increase the degree of infestation in several localities. As such fields, when taken over from the tenants are generally replanted in bananas without any measure being previously applied to eradicate the pest, serious losses have been frequently sustained there.

In view of the situation, considerable time was devoted to this problem. An extensive field survey covering an area of approximately 3,500 acres of banana plantations was conducted to estimate the losses caused by that pest, and to study the best measures of control that could be economically applied to combat the pest under local conditions.

The opportunity created by the field survey was taken to study also, the economic status of the other pests which attack banana in Jamaica. The results of those investigations have now been recorded in all issillustrated Bulletin on 'Pests of Banana in Jamaica'. This paper which is now under print has been prepared with the view of conveying to planters all necessary information on the subject. Several lectures on the same subject were delivered in various parts of the country to gatherings of planters directly interested in the subject.

The depredations caused by that pest during the year, have again brought to the forefront the desirability of undertaking researches that might lead to the importation in Jamaica of a natural enemy that could combat the pest.

That question which has been the subject of special reports from me and which is also dealt with in the publication mentioned above has received the kind consideration of the Agricultural Adviser to the Colonial Office during his recent stay in this island.

The members of the Advisory Committee on the Banana Industry also took great interest in the question. The proposals which they received from Dr. J. G. Myers on a scheme for conducting researches in the Eastern Hemisphere was submitted to the Government.

Citrus.—On account of the constant humidity, which has prevailed for the greater part of this year in most districts where citrus are grown the entomophagous fungi which in this island are the main agents which control scale insect infestations, considerably reduced the damages which these pests usually occasion.

Whilst little damage was thus done by scale insects to the trees themselves the usual difficulties in clearing fruits for export have also from that account been considerably reduced and the fruits which have been picked from the beginning of the present crop have been unusually clean and free of blemishes caused by scale insects.

The necessity of spraying for the control of scale insects, a practice which was gradually becoming more generalized during the last few years, has been consequently less obvious to the layman than usual. When visiting groves and advising planters all opportunities are therefore taken to point out that the scarcity of scale insects this season is due to momentary environmental conditions, and that systematic control by artificial methods should be resumed as soon as atmospheric conditions will become normal.

Damages caused by Solenopsis geminata to young plants has increased in importance as the number of budded plants which have been set in the groves have considerably increased during the recent past. Destruction of the tender bark of young shoots being more serious whenever the buds are placed on old stems cut only a few feet from the ground.

As that pest actively fosters the green scale, Coccus viridis, the depredations it causes is thereby often considerably increased.

Grease banding, smearing attacked tissues with Bordeaux paste and systematic destruction of the formicaries by fumigation or by soaking the soil in which they are situated with a weak kerosene-jeys solution have proved to be practical and effective measures for reducing the damages caused by those ants.

On account of the strong winds which by blowing the fruit against thorns, branches, etc., caused abrasions on the rind of the fruits and on account of the weakening of the epidermal cells of the rind by the prolonged periods of heavy rains which occurred, damage caused by Cremastogaster brevispinosa to oranges has frequently been severe: sweet oranges being especially liable to their attacks.

Those ants gnaw the cellulosic tissues of the rind of citrus fruits wherever the oil cells have been damaged. As for the damage they thus cause, as well as for other reasons, the presence of those ants in citrus groves is prejudicial, the eradication of their arboreal nests on the trees is recommended.

It is unfortunate that the fact that those ants have for many years been disseminated by citrus growers to fight the Citrus Black fly, make certain planters, who have purposely disseminated the formicaries on their trees, reluctant to undo now what they have been striving to accomplish for many years.

The remarkable results which are being achieved with Eretmocerus serieus to eradicate the Black fly is, however, gradually convincing many planters that the useful purpose ascribed to the ants can now be obtained without any disadvantage by the action of those wasps.

Dissemination of Eretmocerus has been conducted so that this useful parasite would become established in centres from which they could rapidly disseminate themselves all over the island in a minimum of time. Those parasitic wasps have thus been liberated on 71 properties scattered in various parts of the island: 11 in St. Andrew, 1 in Kingston, 7 in St. Mary, 3 in Portland, 5 in St. Ann, 3 in St. Thomas, 13 in St. James and Hanover, 8 in St. Catherine, 6 in Clarendon, 3 in Trelawny, 4 in Westmoreland and 7 in Manchester.

Those beneficial insects have also been established in all the Government Citrus Nurseries, they will thus be distributed throughout the island with the plants which are taken from those nurseries. Owners of private nurseries have also been given every encouragement to establish these wasps in their holdings.

Another important centre of propagation has been established at Grove Place. Planters from that part of the island and all those who visit that Experimental Station can thus, by applying to Mr. Thelwell, easily obtain parasitised material for their groves.

Coconut:—During the later part of the year outbreaks of Asterolecanium palmae occurred over restricted areas on the north coast. The foci of intensive infestation remained localized to patches where the trees had suffered more intensively from adverse climatic conditions. Those small outbreaks were reported to be of short duration, subsiding without artificial methods of control having to be applied. The damage done was in no case of much importance.

Pimento:—An inspection of citrus groves in Manchester gave the opportunity to pay a visit to the area previously recorded as infested by the White Fly: Aleurodicus pimentae. The area already recorded as being infested for many years has not increased. The pest which thus remains localized to regions described in previous annual reports was this year found to cause very little damage. The reason for this being, that on account of the constant humidity, which had prevailed during the preceding months, had allowed the entomophagous fungus: Aschersonoia aleurodis practically to eradicate the pest where during periods of dry weather it breeds in great abundance. The results that would be obtained if reafforestation and establishment of wind breaks were as recommended in my previous reports on the subject undertaken in that area is thus demonstrated in a very striking manner.

Cacao:—The thrip: Heliothrips rubrocinctus has been very little in evidence this year. The only organism reported as causing damage to this crop has been rats, which, probably deprived of other sources of food by the abnormal rains which prevailed, attacked cocoa pods to a greater extent than usual.

Sisal:—Visit to sisal plantations with reference to damage done by floods, etc., gave an opportunity to investigate the economic status of these insects which are recorded as attacking this plant in Jamaica. All over the large plantations visited, the plants were found remarkably free from insect pests.

Truck crops:—Considerable time has been spent in investigations of insect activity in connection with the new born vegetable industry. The results that can be of practical use to truck crop growers are being regularly published in the Journal of the Agricultural Society in a series of popular articles, whilst all other information that are being gathered on the subject will form the subject of a Departmental Bulletin.

As there are good reasons to believe that in many cases the systematic elimination of breeding places will, under local conditions, be of considerable significance for the economic control of those pests, special attention is being given to the wild and cultivated host plants of each of those pests concerned.

Examination of Plants for export and for import.

As there is no plant Quarantine Inspector on the staff of this department, considerable time had to be spent on the inspection of plants, and matters of vegetable origin, entering or leaving the island.

The importation of ornamental plants (especially from neighbouring countries which have no inspection service) packed in materials which could harbour insect pests presenting considerable danger with regard to the possible introduction of destructive pests, that question was called to your attention and suggestions were made with regards to the requirements specified on the Permits that are issued for such Importations.

Extension and Educative Work.

The total lack of opportunities which the youth of this community has to get their attention directed to the application of biological sciences to agriculture, results in an ignorance of elementary facts about natural history. This deficiency constantly appears as a great handicap for the rational application by planters of methods aimed at controlling insect pests. It has therefore been my intention to build gradually a small museum of economic entomology which could later be transferred to the Institute of Jamaica to form a division of their general Museum.

In spite of urgent and time absorbing duties in other directions that question has not been lost sight of during the year and additions have been made to the exhibits gradually built up during recent years. The lack of skilled assistance in the laboratory has, however, not allowed the evolution of that collection beyond the nuclear stage.

A small collection of the common insects which frequently attack citrus in this Island was offered to the Citrus Producers Association.

Popular articles on entomological subjects were contributed to the Journal of the Agricultural Society whilst lectures were delivered to planters in various parts of the Island.

At the special request of the Instructors of the Jamaica Agricultural Society two lectures accompanied by demonstrations were delivered during the Agricultural Week held at Hope during the summer vacation of Hope Farm School.

W. H. Edwards,
Govt. Entomologist.

V. PLANT BREEDING.

Report of the Government Geneticist.

I have the honour to submit hereunder my Report for the year 1933.

1. Introduction.

The Geneticist's Laboratory first became available for use on April 4th, 1933.

The initial three months of the year under review were occupied in superintending the furnishing and equipment of the laboratory, in examining the records of previous banana breeding work in the Island and in visiting the various experimental plots at which banana seedlings were being raised and tested.

During the same period several visits in company with other members of the Department were made to different parts of the Island, a study being made of details of the cultivation of the banana and other crops in Jamaica.

2. Musa Cytology.

Preliminary work involved the development of a reliable cytological technique suitable to the peculiarities of the banana and the climate. The technique finally adopted for root-tip examination is a modification of La Cour's. (Journ. Roy. Microsc. Soc. LI. 1931 p. 119).

The general cytological programme has been directed towards determining the chromosome numbers of as many of the seedlings and varieties of banana and plantain available in the island, as possible, with a view to establishing a breeding programme on sound cytological lines. In all, 197 fixations have been made,

and the chromosome numbers of 53 of the seedling varieties and 20 of the standard types have been determined. The latter include the following varieties:—Gros Michel and 5 sub-varieties, Robusta (Congo), Ramkelat (Red), Rubra (Green Red), Lacatan, Bumulan, China (Cavendish), Honey (Sucrier), Whitehouse (Bluggoe), Apple Plantain, Giant Fig, Fillbasket (Mysore), Giant Plantain. The general conclusions indicated are that:—

(a) the basic number of the genus Musa (x) is 11.
(b) the original parents of the bulk of our seedings, namely, Gros Michel and Robusta are triploid, 2n =33.
(c) the first generation (F1) seedlings are tetraploid 2n =44.
(d) the backcrosses to both parents yield progeny of which half are euploid (3x, 4x, 5x, 7x.) and half are aneuploid plants.
(e) the 18 other sterile edible varieties are triploid with two exceptions, Honey, and Apple which are both diploid.

Some of these findings have been confirmed by a study of meiosis during pollen development in representative seedlings.

Details of this work will be published separately when this survey of the seedling collection is complete.

A comparative study of the quantity and variability of the pollen produced by the seedlings and varieties has been initiated as a preliminary indication of their fertility for further breeding work.

3. Banana Breeding.

The Departmental programme of banana breeding for immunity to Panama Disease has been considerably curtailed during 1933 as a result of the weather conditions. The storm of November 9th, 1932, blew down all but the youngest stems of the stock of breeding material which was then located at Castleton Gardens, at Spanish Town Prison and at Dawkins in St. Catherine. These three plots then carried about 1,000 plants including both seedling and standard varieties. As a result, the seedlings from Dawkins were replanted in a variety trial (see below) in two plots, at Coleraine (St. Mary) and Caymanas (St. Catherine). Breeding could only be recommenced at Castleton by February 1st and did not approach normality until late in June. The plot at Spanish Town was maintained as a source of seedling suckers for planting out later in the year. On four subsequent occasions during the period under review, namely June 29th, August 5th, October 4th and 29th, further stems totalling 201 were lost at the breeding plots as a result of heavy rains, and many of these had already been pollinated. On May 12th, one of the Castleton plots with 560 Gros Michel plants had to be abandoned owing to encroachment of Panama Disease, but was replanted with immune seedlings which had not come into bearing at the end of the year, but which will be available for pollination during 1934.

A summary of the pollinations carried out, seed obtained and seedlings raised during the five years 1929-1933 is given below in Table I.

Table I.

Pollinations 1929-1933.

Year.	Bunches. Pollinated.	Seed Obtained.	Seed Germinated.	Seedlings Established.
1929 ..	..*	..*	48	21
1930 ..	..*	..*	31	3
1931 ..	127†	5†	35	30
1932 ..	1,379	103	13	6
1933 ..	401	6	1	..

* No record.
† Records incomplete.

Pending the accumulation of cytological information upon which to base breeding work, pollinations were carried out along the lines previously used here by Mr. Sutherland, namely crossing Gros Michel by Robusta and backcrossing the progeny (F1) to both parents. The main additions to this programme have been the recommencement of crosses between Gros Michel and the fertile wild type, *Musa* 'Kewensis' (probably *M. zebrina* Van Houtte.), and intra-clonal fertilisations of the F1, S7, S 17, and S 19, in order to raise an F2 generation. A third new line has been the use of the 'Highgate' variety which is a dwarf form of the Gros Michel having a larger bunch, in an effort to combine increased finger and bunch size with wind resistance and immunity to Panama Disease. In Table II the Highgate crosses are included with those of the Gros Michel but the six seed produced by the cross G.M. x Kewensis were obtained from Highgate bunches.

The depleted stock of Gros Michel in the Departmental plots has been augmented by the addition of an acre of Gros Michel at Agualta Vale which have been pollinated with Robusta pollen. Work was commenced in this plot during May. Pollinations were commenced at a second new plot in St. Mary at Crawle, on September 21st. Here the crosses undertaken were backcrosses of S7, S17, S19 to both parents, Gros Michel and Robusta. Table II summarizes the crosses of the various types which have been carried out during 1933.

TABLE II.

Summary of Pollinations 1933.

Cross.	Plots.	Bunches poll'd.	Bunches Lost.	Bunches cut.	Seed Obtained.
Gros Michel* (3x) x Robusta (3x)	..Agualta Vale	184	39	135	0
G. M. x Kewensis (2x) ..	..Castleton	42	4	31	6
G. M. x G. M. ..	..Agualta Vale	28	0	28	0
G. M. x Immune F1 (4x)	..Crawle and Castleton	96	24	19	0
F1 x Robusta.. ..	..Crawle	16	1	5	0
F1 x F1	..Coleraine	22	0	0	0
Other vars. (3x) x F1 ..	..Castleton	11	0	2	0
Sundry crosses ..	.. Do.	2	0	2	0
Total		401	68	222	6

* Including the sub-varities of Gros Michel-Highgate, Glengoffe, Weeping J'a., Plantain J'a., Pink J'a.

Of five wild types imported in 1932 from Trinidad for use as male parents, namely *Musa brachycarpa*, *M.* 'Samoa,' *M. truncata*, and *M. zebrina* (two strains), only *M. truncata* has failed to survive. They have been grown in quarantine at Hope and have all proven immune to Panama Disease.

M. zebrina A. has suckered prolifically and will be used for large scale breeding with Gros Michel during 1934; the others will be similarly used as sufficient suckers are developed. One bunch of Zebrina E was pollinated at Hope with pollen from Zebrina A, the bunch was cut in December and 2,243 seed obtained from it. 120 of these have been sown, but up to the end of the year none had germinated.

4. BANANA VARIETY TRIAL.

In January two three-acre plots were planted with seedling suckers to test the marketability of the seedling bunches. One plot, at Coleraine, was of land heavily infected with *Fusarium cubense* and the other at Caymanas was free from Panama Disease. The suckers planted consisted mainly of the F1 seedlings S7, S17, S19. S20. A portion of each plot was planted with a few plants of each of the other 54 seedling varieties for the purpose of bulking up suckers and testing immunity. All but 3 of the seedlings proved immune, those 3, all F1 plants, namely S20, S24, S29, appeared susceptible, though S20 is fairly resistant.

The Coleraine plot suffered considerable damage as a result of river encroachment and flooding on several occasions during the year, and of the 1,089 suckers planted there, 589 were washed away and the remaining 500 plants shot poor bunches.

The Caymanas plot, which was cultivated under irrigation, was not noticably damaged by the weather, but the bunches produced have formed short fingers and rarely exceeded seven hands in size, so cannot be regarded as yet suitable for the market. The fruit is however of good flavour and texture and it is expected that backcrossing to Gros Michel will improve the grade of bunch.

Two one-acre plots were planted early in the year with Cavendish suckers which have borne well, and a shipping trial of this variety will be carried out early in 1934.

5. PAPAW SELECTION.

Owing to the unabated spread of Mosaic of the Papaw (*Carica*) *papaya* throughout the Island during the last few years it was decided in March to examine the possibility of securing a resistant strain of the plant. Seed from 35 different types of plants were sown and a small plot was set up at Hope. So far no plant has shown marked signs of resistance and it is now proposed to test out several of the wild species of *Carica* as possibilities upon which to base a breedng pogramme.

6. PUBLICATIONS, ETC.

A short article on 'Breeding for Immunity' was contributed to the Journal of the Jamaica Agricultural Society.

A lecture entitled 'Banana Varieties and Breeding' was delivered on July 25th in connection with the Short Course at Hope.

Two meetings of the 'Advisory Committee to the Banana Industry' were attended at the invitation of the Chairman.

Mr. Sutherland, Supervising Inspector of Plant Diseases, has co-operated with me in the work reported above. He has been responsible for the supervision of the bulk of the field work and has provided valuable assistance both of a practical and advisory character.

I wish to acknowledge my indebtedness to Messrs. P. A. Bovell, M.O.V. ffrench-Mullen, G. A. Hawkins and H. W. R. Scott and their assistants for their willing co-operation in the field experiments.

L. N. H. LARTER,
Geneticist.
6.2.34.

VI. AGRICULTURAL EDUCATION.

Annual Report of Headmaster Government Farm School, 1933.

I have the honour to submit herewith my Annual Report for the year 1933.

General.—The Farm School concluded a satisfactory year's work with a slight increase in enrolment, and a higher standard being maintained, due mainly to the fact that the student's entering have a better educational background. This facilitates the work of the Staff and results in a better class of work generally. More interest is being shown in the School by the public and a large number of applications for admission were received.

Enrolment—A maximum number of 48 students were in attendance during the year. The number in each year was as follows:—

First Year	17	students.
Second Year	14	"
Third Year	17	"

At the annual Graduation, which was held on July 14th, seventeen students were graduated and received Diplomas in Agriculture. His Excellency the Governor, Sir Ransford Salter G.C.M.G., very kindly consented to preside at the Graduation and present the Diplomas to the students.

The students who received diplomas were:—

Leslie Alfred Arscott	Spaldings
Lionel Adrian Barrett	Rose Hall
Allan Victor Cameron	Bluefields
Frank Emanuel DaCosta	Buff Bay
Roland Albert Gale	Wakefield
Arnold Cleveland Harris	Kingston
A. George Heron	Mandeville
Egbert Jocelyn Irving	Blackstonedge
Alvin S. McKenzie	Trout Hall
Flavius McKinley	St. Ann's Bay
Henry Horatio Nelson	Cross Roads
Wilfred Vincent Nelson	Walderston
Harold George Nicholson	Mocho
Septimus Wilfred Romans	Adelphi
Eric Ezra Saams	Wait-a-bit
Robert Samuel Sharpe	Lodge
Ethelbert Watson	Cascade

Prize Awards—The prize for General Proficiency in the Third Year was awarded to Wilfred Vincent Nelson, with an average of 87%.

The Prize for General Proficiency in the Second Year was awarded to Maurice C. Hay who had an average of 84%.

The Prize for General Proficiency in the First Year was awarded to Victor Emmanuel Anderson who had an average of 84%.

The prize of a cricket bat, donated by M. S. Goodman, Esq., and awarded to the student making the greatest improvement in cricket during the year was awarded to Austin Hamilton Lawrence, a Second Year Student.

School Activities.—The Farm School took an active part in Education Week which was held in June. The students contributed a display in physical exercises to the Vocational Education Programme at the Ward Theatre, and an "Open Day" was held at the School during the week at which work done by the students was displayed. The function was well attended and a keen interest shown by the visitors.

Student Christian Movement.—The Farm School Branch of the Student Christian Movement completed a successful year's work. Services were held every Sunday at the School and served a most usefu purpose in the life of the Student. In June an "At Home" was held by the Farm School Branch to the other branches from the various schools. I wish to again express my appreciation to Mr. E. B. Hallett of the Y.M.C.A. for the interest that he has taken in this phase of the School's activity.

Sports.—A very successful Sports Day was held in March. The number of entries in all the events was gratifying and the competition keen.

Cricket and football were played with outside teams during the year. The School was entered in the Third Division Competition in football and came fifth out of ten teams in the Competition.

Health of the Students.—The health of the students during the year was satisfactory. No outbreak of infectious disease occurred. The students were regularly inspected by the School Doctor at the beginning of each term.

Grove Place.—The Third Year Students spent half their time at Grove Place each term. Due to the acute water shortage during the Midsummer Term it was not possible for them to spend the full time at Grove Place. They did however spend some time there during the term.

Having the Third Year Students spend some time at Grove Place provides a means of giving them instruction in all phases of agriculture. The work done there is mostly practical in nature and covers such phases of agriculture as cannot be taken at Hope.

Field Visits of Students.—The Third Year Students visited places of interest in connection with their work during the year, both at Hope and at Grove Place. Such places as citrus packing houses, model small holdings, sugar factories and coffee properties were visited.

Improvement of School Grounds.—During the year considerable work was done in improving the school grounds. Definite pathways were laid out and the roads improved. It is hoped that it will be possible to plant the grounds permanently to shrubs and trees and start has already been made in this direction. His Excellency the Governor kindly consented to plant a tree in connection with the graduation progamme and it is hoped that with this as part of the programme each year a class graduates, a record of each class graduating will be provided.

I was appointed by the Government with the Director of Education to tour the Southern States and study the system of Vocational and Agricultural Education there. The tour covered six weeks from early October until the middle of November, and was made possible through the generosity of the Carnegie Corporation of New York. During the tour I had the opportunity of seeing all phases of agricultural education and vocational education and secured much information which will be of use in the work at the Farm School.

I wish to take this opprtunity to express my appreciation of the co-operation received from the Head Office, the Government Laboratory and Hope Gardens during the year. I wish also to express my appreciation of the co-operation received from the Staff of the Farm School.

J. W. Howe,
Headmaster.

Annual Report of the Farm Superintendent.

I have the honour to submit herewith my annual report for the year 1933.

The year under review was a trying one for livestock in Jamaica, due to the prolonged dry period. The drought caused considerable inconvenience from the lack of water and the shortage of pasture, and cattle suffered as a consequence. During this time the value of silage and the advisability of some form of feed storage was amply demonstrated, and stock raisers who had made provision for the storage of feed were well rewarded for their efforts.

Cane served a very useful purpose during the dry period and this, with the use of silage, maintained the flow of milk despite the adverse conditions.

Breeding Operations.—The policy of crossing the northern breeds with the Montgomery (Zebu) was continued with good results. It would appear that the Jersey and Guernsey make the better crosses for this climate, and the breeding operations as far as crossing is concerned, are being concentrated on these two breeds.

Increase in the herd.—During the year 149 calves were dropped. Of this number 48 were sold, the majority of them for breeding purposes.

The demand for calves was not so great this year as in former years due probably to the lack of feed from drought. The Red Poll herd is showing improvement and the calves by Newhall Theagenes, the recently imported bull of this breed are showing up well.

Summary of Livestock—Hope Stock Farm, December, 1933.

Pure Bred Cattle.

	No. Head.	Total.
Brown Swiss		
Cows	2	2
Guernseys—		
Bulls and Bull Calves	3	
Cows and Heifers	8	11
Holsteins—		
Bull and Bull Calf	2	2
Jerseys—		
Bull	1	
Cows and Heifers	22	23
Montgomerys—		
Bull	1	1
Red Polls—		
Bull	1	
Cows and Heifers	31	32
Total Pure Bred Cattle		71
Grade Cattle—		
Grade Ayrshires	5	
" Brown Swiss	16	
" Guernseys	101	
" Holsteins	38	
" Jerseys	85	
" Montgomerys	44	
" Natives	6	
" Red Polls	10	305
Steers		17
Grand Total Cattle		393
Horsekind—		
Mules		19

Valuations of Livestock.

1930.	1931.	1932.	March, 1933.	December 1933.
£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
7,851 8 0	8,395 0 0	8,503 4 3	8,698 15 0	8,145 16 0

Milk production—The farm during the year produced a total of 236,391 quarts of milk, an increase of 13,468 quarts over 1932.

A number of unprofitable cows were sold from the herd for butcher purposes during the year, and it is hoped that by rigid selection the production of the individuals in the herd will be increased.

The public instituions in Kingston continue to take the greater percentage of the milk produced, and with few exceptions during the very dry time, the Farm was able to fill the requisitions.

The table below shows the production of the five highest cows in the herd for the year.

No.	Name.	Breed.	Age in Years.	No. days milked.	Total production (lbs.)	Value.
						£ s. d.
1	Norbrook 3rd	Gr. Holstein	9	313	7,165	69 2 7
2	Norbrook 4th	Gr. Jersey	8	313	6,750	65 2 10
3	Fayne's Tilda	Gr. Holstein	4	365	6,617	63 16 10
4	October ..	Brown Swiss	12	365	6,443	62 3 7
5	Susuki	Gr. Ayrshire	5	365	6,055	58 8 10

Butter.—The amount of butter made for the year was 1,357 pounds. The amount of milk available for butter manufacture was limited due to the high requisitions, and the long drought.

Silage.—The long drought necessitated the using of practically all the silage made in 1932, and consequently a large acreage had to be planted this year. The amount of silage made totalled 543 tons for the year. The crop used is guinea corn which is cut in the early "dough" stage. Heavy rains toward the end of the year caused rank growth resulting in heavy yields and a good quality of silage.

Experiments were conducted during the year with the use of a pit silo, using both guinea corn and guinea grass as a silage crop. Results of the experiment will not be available until the pits are opened in March.

Poultry.—In 1921 the Farm began concentrating on the Rhode Island breed of fowls, and by 1925 all other breeds were eliminated. Since that time the Farm has kept no other breed but the Rhode Island Red which has been found to be one of the most suitable dual purpose breeds of poultry in Jamaica.

The present flock is of Canadian strain and is descended from a pen imported in 1930 for the University of British Columbia. The pen imported consisted of a 300 egg hen and three yearling hens which produced 284, 273 and 241 eggs respectively in their pullet year in Canada. The best pullet form this stock produced 166 eggs in her first season.

During the year 150 eggs and 14 cockerels were sold for breeding purposes, and 256 chicken were hatched, many of which were sold as day old chicks to the public. A total of 1,580 eggs was sold to the Farm School and 480 to the Public Hospital for table purposes.

It was found that the fertility of the eggs was very low and in consequence of which the sale of eggs for hatching was discontinued. Tests were made to determine if possible the cause for the low fertility and it was found that the pens receiving coconut meal in their ration showed a lower fertility than those fed other feeds. Definite statements cannot be made on only one experiment and further experiments will be conducted next year.

Improvements—General repairs were carried on throughout the year to the buildings and equipment. The buildings at the Top Yard were re-roofed.

Roads were improved and graded, and drainage ditches cut to carry away the surface water. The yards are now well drained and little water settles even during the very wet weather.

The site for the new 100 stanchion dairy building was selected and excavation started in November. When this building is completed there will be room for 160 head centrally located which will facilitate the work of milking and feeding the main dairy herd on the Farm.

Tours of Inspection—The Farm encouraged people to visit and see the stock during the year, and a large number of people availed themselves of the opportunity. Especially is this true of the branches of the Jamaica Agricultural Society, a number of whom arranged visits to the Farm.

I wish to express my appreciation of the excellent co-operation received from the Staff of the Farm during the year.

J. W. Howe,
Farm Superintendent.

Hope Stock Farm, Nine Months ended December 31, 1933.

Cash Appropriation.

Receipts.		Approved Estimates. for 1 year.	Revised Estimates. for 9 months.	Actual for 9 months.
		£	£	£ s. d.
Balance on 31.3.33		2,507	2,849	2,848 11 0
Milk Sales		4,300	3,666	3,668 3 5
Butter Sales		100	84	84 6 10
Live Stock Sales		400	410	410 8 0
Poultry Sales		35	19	19 2 4
Rents		200	180	179 12 5
Bombay Mango Sales		350	450	447 6 5
Pine Sales		20	7	7 11 0
Miscellaneous:—				
Interest (Bank)	£75 7 2			
Truck (Refunds)	19 1 11			
Feeds (Refunds)	1 5 9			
Ja. Prod. Marketing Co., Ltd. (deposit)	20 12 9			
P. W. Department (Refund	11 0 6			
Refund by New York Agents for repairs machy.	1 16 8			
Sundries	23 19 5	150	151	153 4 2
		8,062	7,816	7,818 5 7

Disbursements.			Approved Estimates for 1 year.	Revised Estimates for 9 mths.	Actual for 9 months.
		£ s. d.	£	£	£ s. d.
Personal Emoluments—					
Accountant		..	150	112	112 10 0
Clerk		..	140	105	105 0 0
Foreman		..	123	90	90 0 0
Wages		..	1,050	809	809 3 3
		..	1,463	1,116	1,116 13 3
Other Charges					
Food for Stock—					
Growing Canes		60 13 5			
Growing Guinea Corn		79 13 9			
Manufacturing Guinea Corn Silage		149 3 3			
Poultry Feeds		22 11 4			
Imported and other Feeds		1,063 12 11	1,700	1,376	1,375 14 8
Crops: Plantation Pines		..	20	15	15 4 4
Rearing Calves: At Grove Place		..	50	..	..
Cleaning and Fencing		..	500	369	368 18 5
Buildings, Machinery and Equipment:—					
Machinery		44 4 0			
Furniture and Fixtures		85 4 8			
Stores and Parts		27 9 4			
Tools and Implements		85 6 7			
Vehicles and Harness		101 7 11			
Buildings		150 18 7			
General Repairs		288 15 10	800	775	783 6 11
Purchase of Live Stock		..	600	75	74 18 10
Miscellaneous—					
Truck		113 19 0			
Rents: Comm.		35 18 6			
Other Exps.		2 15 0			
Bombay Mangoes Comm.		54 11 8			
Other Exps.		82 13 2			
Butter, Ice., etc.		6 19 2			
Taxes		11 4 0			
Valuation, Fees and Travelling		16 14 0			
Poultry Exps.		1 6 10			
P. W. Dept. Advance		11 0 6			
Ja. Prod. Marketing Co., Ltd. Refund		20 12 9			
Sundries		142 19 3	650	510	500 13 10
		..	5,783	4,236	4,235 10 3
Balance: In Bank Nova Sotia		3,580 14 7	..	..	..
In Hand to be lodged		2 0 9	..	..	3,582 15 4
					7,818 5 7

N. B. Donaldson, Accountant.

A. C. Barnes, Director of Agriculture.

Hope Stock Farm, Nine Months ended December 31. 1933.

Profit and Loss Account.

Dr. Cr.

	£ s. d.	£ s. d.		£ s. d.
To Depreciation:			By Rents	140 18 11
Buildings	70 12 4		Bombay Mangoes ..	310 1 7
Machinery	94 12 5		Milk	3,791 17 9
Furniture and Fixtures	51 2 2		Butter	77 7 8
Truck	10 0 0		Interest (Bank) ..	75 7 2
Tools and Implements ..	112 8 8		Miscellaneous Revenue	42 9 6
Vehicles and Harness ..	50 5 6	389 1 1		
Repairs and Upkeep:				
Buildings ..	58 4 2			
Machinery ..	42 7 4			
Furniture and Fixtures ..	21 14 3			
Truck (including running expenses)	73 3 10			
Tools and Implements	15 8 0			
Vehicles and Harness	97 10 8			
General Repairs ..	304 3 5	612 11 8		
Larceny:				
Truck	21 1 3			
Tools and Implements	3 5 0	24 6 3		
Food for Stock: Consumed		1,012 13 6		
Plantation: Pines		7 13 4		
Taxes		11 4 0		
Rearing Calves at Grove		10 12 0		
Clearing and Fencing		393 9 5		
Wages		809 3 3		
Accountant		112 10 0		
Clerk		105 0 0		
Foreman		90 0 0		
Livestock: Cattle and Mules		201 4 10		
Poultry		9 3 4		
Experiments: Guinea Corn Silage		17 8 4		
Miscellaneous Expenses		155 18 7		
Balance (net profit for 9 months April 1-Dec. 31, 1933)		476 3 0½		
		£4,438 2 7		£4,438 2 7

N. B. Donaldson, Accountant.

A. C. Barnes, Director of Agriculture.

Hope Stock Farm, Nine Months ended December 31, 1933.

Balance Sheet.

Assets.	£ s. d.	£ s. d.
Buildings—		
As at 31.3.33	2,838 7 4	
Additions ..	92 14 5	
	2,931 1 9	
Depreciation	70 12 4	2,860 9 5
Machinery—		
As at 31.3.33	1,426 16 1	
Depreciation	94 12 5	1,332 3 8
Furniture and Fixtures—		
As at 31.3.33 ..	979 6 11	
Additions ..	63 10 5	
	1,042 17 4	
Depreciation ..	51 2 2	991 15 2
Truck—		
As at 31.3.33 ..	100 0 0	
Depreciation ..	10 0 0	90 0 0
Tools and Implements—		
As at 31.3.33 ..	269 17 9	
Additions	67 8 7	
	337 6 4	
Depreciation ..	112 8 8	224 17 8
Vehicles and Harness—		
As at 31.3.33 ..	358 12 9	
Additions	1 9 3	
	360 2 0	
Depreciation ..	50 5 6	309 16 6
Stores and Parts: Stock as per Investory ..	..	176 13 7
Food for Stock: Stock as per Inventory	..	841 11 0
Plantation: 1 acre Pines ..	..	50 0 0
Livestock: Cattle and Mules as per Inventory ..	8,095 16 0	
Poultry as per Inventory	50 0 0	8,145 16 0
Accounts Receivable—		
Public Hospital ..	33 18 0	
F. E. V. Smith ..	0 14 5	
E. Downes	0 19 4	
Farm School ..	3 16 0	
Lunatic Asylum ..	134 3 6	
General Penitentiary ..	23 5 0	
Jubilee Hospital ..	1 16 9	
Govt. Laboratory ..	19 0 0	
Barnett Estates ..	2 0 0	
B. C. Deans ..	1 0 0	
R. A. Amiel ..	1 0 0	
Alonzo Rowe ..	8 10 0	230 3 0
Cash:—		
In Bank Nova Scotia	3,580 14 7	
In Hand to be lodged	2 0 9	3,582 15 4
		£18,836 1 4

Liabilities.	£ s. d.	£ s. d.
Accounts Payable—		
Treasurer for New York Agents ..	72 11 6	
Treasurer for Crown Agents	8 3 11	
Fernando Castro	1 3 8	
Grove Place (for Rearing Calves)	10 12 0	92 11 1
Jamaica Government—		
Balance of grant for setting up Live Stock ..	..	606 6 0
Profit and Loss—		
As at 31.3.33	17,661 1 3	
Add profit (9 months) April—Dec.	476 3 0	18,137 4 3
		£18,836 1 4

N. B. Donaldson. Accountant.

A. C. Barnes Director of Agriculture.

Report of the Superintendent Government Stud Farm and Experimental Station.

Grove Place, Mile Gully P.O.

I have the honour to present my Report for the year 1933.

A. Live Stock.

1. *Valuation.*—The valuation of Live Stock took place this year in December. The total value of the stock is £2,209 2s. 0d. Previous valuation figures are: March, 1929, £1,867 0s. 0d.; 1930, £2,322 15s. 0d; 1931, £1,846 15s. 0d.; 1932, £1,717 0s. 0d.; 1933, £2,321 0s. 0d. The figures this year have been based on the fallen price of stock. Animals were classified as follows:

Cattle.	No. Head.	Value. £	s.	d.
Bulls and Bull Calves	21	417	0	0
Pedigree Cows and Heifers ..	3	23	0	0
Native Cows	85	745	0	0
Grade Heifers	34	186	0	0
Cow Calves	16	31	0	0
Steers	4	72	0	0
	163	1,474	0	0
Horsekind	36	599	0	0
Pigs	8	106	2	0
Sheep	1	30	0	0
Grand Total	208	£2,209	2	0

2. *Stud Service.*—The Stud Service for Mane Stock, cows, sheep and pigs has been maintained throughout the year, and that for goats for six months.

The Small Stock Stud Service has proved fairly popular.

Animals standing for service are as follows:—

Horsekind	Snow Boy—English Thoroughbred.
	Kentucky Boy—Imported Proof Ass
Bulls	Etta's Pogis—Jersey
	Glen's Prefect—Jersey
	Cortes—Montgomery-Guernsey
	Justice—Montgomery-Brown Swiss
	Lad—Imported Red Poll
Sheep	Tendering Token—Imported Suffolk Ram
Goat	Stockwell Callum—Imported Toggenburg Buck
Swine ..	Ritchings Bon Accord—Imported Berkshire Boar.
	Grove Marquis—Native Berkshire Boar

Summary of Service:

Mares to Stallion	Visiting	36	Farm	3	Total	39
Mares to Jack	do.	11	do.	3	do.	14
Jennets to Jack	do.	3	do.	2	do.	5
Cows to Bulls	do.	37	do.	53	do.	90
Ewes ..	do.	44	do.		do.	44
Does ..	do.	43	do.		do.	34
Sows ..	do.	24	do.	2	do.	26

Previous Service figures are:

Mares to Stallion:	1929	nil;	1930	54;	1931	62;	1932	44.
Mares to Jack	do.	17;	do.	11;	do.	7	do.	9.
Jennets to Jack	do.	4;	do.	4;	do.	3;	do.	2.
Cows to Bulls	do.	59;	do.	86	do.	95;	do.	93.

3. *Health.*—The Suffolk Ram suffered from penumonia during the summer. He has recovered and proved.

The Toggenburg Buck and does with their kids died from pneumonia during the summer flood rains. Arrangements have been made to resume this service by further importation.

Other animals maintained good health. "Snow Boy," the stallion has shown much improvement. The 18-year old proof ass "Kentucky Boy" is still full of vigour. All mares put to him "stinted;" the Farm now has a very superior lot of young mules.

Tuberculin Test and vaccination with Blackleg Aggressin operations were undertaken. There were no re-actors to the Test.

4. *General.*—The imported Jersey Bull "Glen Fontaine's Lad" was superannuated and destroyed.

In continuation of the policy of "weeding out," a number of old cows and those unsuited to our work, were drafted and sold to the butcher.

Three 3-year old mules were broken to draft for Farm Work.

Five 3-year old mules will be ready for sale in 1934.

The tedious work of grading-up a herd from native cattle is at last beginning to show results, and a number of Dairy Heifers will be broken in in 1934.

The whole of our breeding programme this year has been directed to confining our efforts to the production of a tropical dairy cow based on only two breeds, the Guernsey and Jersey with suitable infusion of Montgomery blood.

The work in Swine has shown good results. Two native gilts, which were farrowed and grown out at Grove Place, compare favourably with the imported sows, and the native young boar Grove Marquis is a splendid specimen of the breed. A new piggery, separate from the service section, was constructed, and root crops grown and fed on the spot. The crops grown were: Sweet Pototoes, Corn, Turnips and Pea-nuts.

Two young boars are being grown out for the Jamaica Agricultural Society, while five shote pigs and one boar were sold.

B. Experiment Station.

1. *Citrus Nursery.*—The Citrus Nursery consisting of Grapefruit of the Marsh variety and Bahia Navel Orange budded on Seville Orange stock proved a success. The plants came through six months' drought in splendid fashion due to continuous light mulching. Persons competent to judge declare the plants to be some of the best they have every seen. The Entomologist pronounced them free of pests. The "Eddie Wasp" was established in the Nursery so that purchasers of the plants received also colonies of the "Wasp." About 3,000 plants were available both for distribution and our own use on the Station. On account of the great demand, the plants were allocated on a ration basis, at the low rate of 1/- each free at railway destination. A large number of these plants have been already distributed and the balance will be sent out early in 1934.

The method of lifting the plants free of earth, puddling them with mud, wrapping the roots in wet grass and shipping in bags in bundles of ten has proved very successful. Every possible precaution was taken to ensure that the plants were budded to the desired varieties. Three sections of Seville Orange Seedlings are now being budded to Marsh Grapefruit, Valencia and Parson Brown Orange.

2. *New Citrus Groves.*—The miscellaneous grove on Section A has remained healthy and made good growth. The Grove on Section B has not grown as well as it might due to "die back" on the Silver Clusters and slugs on the whole grove. The Silver Clusters are being gradually replaced by our own plants of other varieties.

Two new groves have been planted—one with Marsh Grapefruit and Bahia Orange, and the other with Parson Brown and Valencia Orange, on Seville orange and rough lemon stock respectively.

3. *Old Citrus Grove.*—This grove produced a heavy, clean crop as a result of pruning, destruction of Black Ants by Cyano-gas, and a general clean up of Black Fly by the "Eddie Wasp."

4. *Banana.*—Both plots were completely blown down by the hurricane of November. One plot was replanted and Over-look Bean sown through as a "cover." A fertilizer experiment (in collaboration with the Agricultural Chemist) is projected for next year. Plot number 2 was pruned and left. The plants of both plots are rivalling banana grown on proper banana soil. It is unfortunate that for the second year in succession the banana trials have been destroyed. From plot number 1 with 505 plants over 400 "count' immature bunches were destroyed. This shows that banana can be grown on the red limestone soils provided they be either heavily mulched or grown under suitable "cover." As mulching is very expensive, experiments are under way to find such a cover. On the other hand, the expense contingent on drainage is saved.

5. *Coffee.*—The new short-top Coffee plot was badly damaged by the banana used as temporary shade. Efforts are being made to find a suitable temporary shade for coffee while the permanent shade trees are growing. Various methods of pruning old long-top coffee are being tried out. It appears as if the old method of leaving three growths of varying ages is best, and the topping of these individual growths produce good results. A large crop was reaped and cured.

6. *Paw Paw.*—A number of varieties has been collected and are now growing on the Station. The trees have remained free of mosaic and produced good fruit. The method of transplanting once before setting out has been given better trees. There are no male trees on the Station, but this does not appear to have affected bearing. The method of planting four trees at one spot and cutting out both the males and less thrifty trees has saved much time and ensured growing only bearing trees.

Progressive topping has resulted in producing fairly low-set trees which fruit on the branches, thus obviating the damage done to fruit when they lean against the trunk. Fruits borne on stems hang free and ripen evenly; they are, however, smaller than those carried on the trunk.

7. *Leaf Mould on Tomatoes.*—The spraying tests carried out for the control of leaf mould have shown that none of the emulsions mentioned in my previous report was as good as 3-3-30 Bordeaux.

8. *Cover Crops and Green Manures.*—Much work has been done on Cover Crops and Green Manures. Large stands of *Crotalaria usaramoensis* and *Crotalaria anagyroides* have been grown. The *C. usaramoensis* appears to be more suited to our needs. Both *Tephrosia candida* and *Tephrosia vogelli*, show much promise. Although *T. vogelli* produces a heavier outcrop, *T. candida*, when topped, branches more profusely.

Indigofera endecaphylla is a shy germinator but may be propagated by slips. It has the advantages of not climbing and of thriving under shade. This legume might be exploited for a banana "cover."

Centrosema pubescens grows readily and makes a good mat but is not coarse enough to smother volunteer growth. As it establishes itself throughout all bush and undergrowth however, it should prove very useful for pastures. Soya Bean (*glycine* Max.) has done well, but like Overlook and Bengal beans and Jerusalem peas, requires occasional dusting against the ravages of caterpillars.

Beggar weed does not produce enough outcrop to compete with either the Tephrosia or Crotalaria as a green manure.

Alysicarpus rugosus did not germinate.

In view of the lack of humus in the limestone sections of the Island and the enormous amount of money expended on mulch, the question of Green Manuring is most important.

9. *Potatoes.*—The work on this crop was mainly directed toward determining

(a) Size of "sets" most suitable for these soils.
(b) Effect of earthing up.
(c) Time of sprouting at which it is best to plant.
(d) Control of blight.

It appears as if (a) depends on depth of planting and the seasons. Under normal conditions the regular two ounce "set" is a waste. Provided there be a sprout "sets" may be as small as possible. With regard to

(b) earthing up little and often gave best results; with regard to (c), sets of oversprouted potatoes lose virility and produce poor results; with regard to (d) 3-3-40 Bordeaux, used every fourteen days was most successful. A fairly extensive varietal test, in conjunction with the Jamaica Agricultural Society, is under way.

10. *Insecticides and Fungicides.*—All proprietary emulsions on the local market were tried out. Most of them gave satisfactory results. Care should be exercised in the purchase of Emulso from large stock. If the container be not agitated prior to retailing, shadowing and defoliation result. Most of the prepared emulsions are too expensive. A cheap, efficient oil spray for Citrus Groves is badly needed.

11. *Other Crops.*—The Pine plot has produced a good crop under heavy mulch. A large variety of vegetables—tomatoes, cabbage, onions, green peas, cauliflower, turnips, carrots—has been grown successfully under mulch, (without watering after transplanting) from January to May and from October to December.

12. *Fodder Crops and Feeds.*—Uba and three varieties of seedling canes have been grown for feeding pigs and cattle. Two large crops of Corn (Spring and Fall) were reaped. Guinea Corn was grown and ensilage made. Cassava, Cocoes (tannia) and pumpkins have been grown. Feed trials with Bone and Blood Meal and Tankage have been started.

C. Agricultural Education.

Senior students from the Farm School spent half of each of their three terms doing practical work at Grove Place. These students take part in all the operations of the Farm and Station. The scheme is working with much benefit to the Agricultural education of the students. Due to scarcity of water in the early part of the year the first term's work was interrupted. Students were conducted on four field observation tours when sugar factories, pens, plantations, packing houses, groves and small holdings were visited. In addition, students also travelled with Agricultural Instructors of the Jamaica Agricultural Society.

D. Lectures and Demonstrations.

Regular lectures and demonstrations were given to Farm School Students in residence at Grove Place, and in addition, lectures were delivered at the Annual General Meeting of the Manchester Peoples' Bank; the Christiana and New Green Branches of the Jamaica Agricultural Society; the Devon Potato Growers Association; the Half-Yearly Meeting of the St. Elizabeth Branches Associated.

A "Message" was sent on request to the Ginger Ridge Coffee Growers' Association.

The Half-Yearly Meeting of the Manchester Branches Association was held at Grove Place when a series of demonstrations was given and exhibits of Feeds and Fertilizers arranged.

E. Plant Distribution, Etc.

Distributions of Pine Suckers, Cane Plants, Vegetable Seedlings , Budwood, Cover Crop Seeds, Coffee Seedlings, Seville Orange Seedlings and colonies of "Eddie Wasp" have been made. In addition arrangements were made with the Forestry Officer for the distribution of a number of timber tree seedlings on the occasion of the meeting of the Manchester Branches.

F. Weather.

Abnormal weather conditions prevailed throughout the year. A severe drought which began early in November continued until the 14th of May, 1933. All ponds and tanks (save one which was down to the last 18 inches of water) went dry. There was no necessity, however, of putting the arrangements made to bring water by train into effect, as the rains fell at the vital moment. During the last month of the drought 1,000 gallons of water had to be bailed and rationed to animals each day. Despite this four months' drought the rainfall for the year reached the record fall of 133.59 inches. The average for the previous five years is 64.55 inches. The work was, of course, seriously hampered by this weather. The present storage capacity for water should be augmented by provision of another tank, as the continuous growth of the Farm daily reduces the safety margin.

G. Leave of Absence and Visits.

I was absent in England on leave for 3½ months. Thanks to the help of Mr. F. E. V. Smith, then Acting Director of Agriculture, Mr. H. H. Cousins, ex-Director of Agriculture and Dr. John Hammond, Head of the School of Agriculture, Cambridge, I was able to visit at my own expense, and get much helpful knowledge of the work at the following places:

The Laboratories and Experiment Station at Rohamstead.
The East Malling Experiment Station.
The Laboratories, Breeding Station and Farm at Cambridge.

Doctor Hammond personally conducted me through all the branches of Agricultural Research and practical work at Cambridge. I also put in some time at a mixed farm at Fawley near Southampton.

(Sgd.) Arthur Thelwell,
Superintendent.

VII. CHEMICAL LABORATORIES.

Report of the Deputy Island Chemist.

The total number of samples analysed during the year ended 31st December, 1933, was 3,905, and compares with former years as under:—

1929.	1930.	1931.	1932.	1933.
2,549	2,665	2,573	3,286	3,905

The samples are classified as follows:—

"A" Official Samples.

(I) *Police*—	
Human Viscera and Organs	101
Vomits	15
Urines	2
Animal Viscera	2
Substances for Poison, etc.	143
Exhibits in Murder Cases:—	
Shot Guns	6
Pistols and Revolvers	2
Cartridges	18
Bullets	6
Firing Experiments	4
Matches (1), Sticks (1), Bush (1)	3
Arson Exhibits	44
Obeah Exhibits (Liquids 3, Bones (1)	4
Documents (1) Fountain Pens (1)	2
Lubricating Oils (1) Petroleum Jellies (1)	2
Under The Coining Laws.	
Coins, Genuine	191
Coins, Counterfeit	210
Notes	7
Counterfeiting Exhibits	406
Under The Dangerous Drugs Law.	
Opiums	22
Opium Exhibits, Pipes, etc.	125
Ganga	417
Ganga Exhibits, Pipes, Rags, etc.	29
Under The Spirit License and Rum Duty Laws.	
Spirits, Rums, Whisky, etc.	216
Under the Medical Laws.	
Medicines, Drugs, etc.	154
Under the Drugs and Poisons Law.	
Poisons, Patent Medicines, Drugs, etc.	40
Total	2,171
(II) *Customs and Excise*—	
Native and other Wines	12
Rectified Spirits and Absolute Alcohols	15
Denatured Alcohols	49
Spirits, Rums, Rum Punches, Liqueurs, etc.	18
Flavouring Extracts and Essences	22
Condensed and Evaporated Milks	11
Fuel Oils (45), and Lubricating Oils (18)	63
Gasolines and Kerosine Oils	17
Disinfectants 11, and Insecticides 6	17
Saccharin	13
Dynamite	6
Chemicals (3), Food Preservatives (1)	4
Foodstuffs (3), Castor Oils (1)	4
Wrapping Papers	2
Fertilizers	1
Instruments for tests	1
Total	256
(III) *Department of Science and Agriculture.*—	
Animal viscera	2
Feeding Stuffs (1), Liqueurs (1),	2
Waxes (2), Soaps (1)	3
Total	7

(IV) *Island Medical Department.*—	
Chemicals and Medicines	5
Waters	9
Soaps (5), Condensed Milks (1)	6
Vegetable concentrates (ackee)	1
Total	21
Medical Officers of Health—	
Kingston and St. Andrew—	
Aerated Waters	76
Fresh Milks, Genuine	1
Fresh Milks, Adulterated	3
Total	80
Other Parishes.—	
Condensed Milks	1
Fresh Milks	1
Fish	1
Waters	4
Total	7
(V) *Department of Public Works.*—	
Feeding Stuffs (Corns)	9
Shale for Petroleum	1
Total	10
(VI) *Island Treasury.*—	
Coins, Genuine (1), Counterfeit (1)	2
(VII) *Postal Department.*—	
Specimen (for identification)	1
(VIII) *Crown Solicitor.*—	
Papers	1
(IX) *Government Printing Office.*—	
Type Metals	1
(X) *Kingston and St Andrew Corporation.*—	
Earths (for Gas purification)	4
(XI) *Government of British Honduras*—	
Condensed Milks	11
(XII) *H. M. Charge d'Affaires, Santo Domingo.*—	
Rice	3
Total Official	2,576

"B" GENERAL SAMPLES.

Government Stock Farm Milks	1,028
Cattle Dips	49
Sugars	117
Rums (44) Alcoholic Liquors (11)	55
Waters, Potable and Boiler Feed	11
Fresh Milks	11
Soaps (6) and Silicate of Soda (3)	9
Edible Oils	3
Plants, Plant Juices and Barks	3
Feeding Stuffs	3
Steam Coals	3
Minerals and Ores	15
Methylated Spirits	3
Deposits ex Mineral Waters	2
Copras	2
Distillery Products	2
Animal Viscera (3) Vomits (1)	4
Miscellaneous:—	
Wrapping Papers (1) Matches (1) Flavouring Essences (1) Galvanized Zinc Sheets (1) Petroleum Jelly (1) Instruments for Test (1)	6
Total	1,329
Grand Total	3,905

The 101 analyses of human viscera and organs, 15 vomits and 2 urines were made in connection with 55 deaths. In 30 cases poison was found and determined in the viscera as follows:—

(1) Arsenic (Cooper's Dip) from the viscera of a female infant.
(2) 0.002 grains Arsenic in organs of a female child.
(3) 0.0015 grains Arsenic in organs of a male child.
(4) Large traces of Tartar Emetic from the stomach and contents of a female.
(5) Traces of Narcotine from the organs of an adult female.
(6) Traces of Hydrococyanic Acid in the viscera of a male child.
(7) Traces of Hydrocyanic Acid in the viscera of a female adult.
(8) Traces of Hydrocyanic Acid in the viscera of a female child.
(9) Large traces of Soluble Oxalates in organs of a female child.
(10) Large traces of Soluble Oxalates in organs of a male child.
(11) 1.801 grains Arsenic from the organs of a female infant.
(12) 0.004 grains Arsenic in the viscera of a female adult.
(13) Traces of Cascara Sagrada and Belladonna alkaloids from the organs of a male adult.
(14) 0.02 grains Arsenic from the viscera of a male adult.
(15) 0.04 grains Arsenic from the viscera of a female adult.
(16) 0.06 grains Arsenic from the viscera of a female adult.
(17) 72 grains Arsenic from the viscera of a male adult.
(18) Ganga Resins from the organs of an East Indian male adult.
(19) 27 grains Turpentine from the stomach contents of a female adult.
(20) Cresols and Arsenic equivalent to 80 grains of Cooper's Dip in a case of suicide.
(21) Powdered glass from the stomach contents of a male adult.
(22) Hydrocyanic Acid from the organs of a female child.
(23) Hydrocyanic Acid from the organs of an infant female.
(24) Hydrocyanic Acid from the organs of an infant male.
(25) Hydrocyanic Acid from the organs of an infant female.
(26) Hydrocyanic Acid from the organs of an infant female.
(27) Carbolic Acid (Jeyes' Fluid) from the viscera of a male adult.
(28) Cresols from the organs of a male adult.
(29) Cresols from the organs of a male adult suicide.
(30) 0.075 grains Antimony from the organs of a female adult.

The substances examined for poison were as follows:—

(1) Powdered glass in sugar.
(2) Carbolic Acid in a liniment.
(3) Carbolic Acid in a liniment.
(4) 73 grains Arsenic in salt causing the death of 4 persons.
(5) Arsenic in cooked food.
(6) White Arsenic in a powder.
(7) Powdered glass in a powder } In case of poisoning of 4 persons.
(8) White Arsenic in a powder.
(9) Cooper's Dip on dress of a murdered infant.
(10) Lysol in a vial.
(11) Lysol in a tumbler.
(12) Lysol in a specimen of vomitus in a case of attempted suicide.
(13) White Lead in 4 poisoned yams.
(14) Potassium Permanganate in a liquid.
(15) Cooper's Dip on 4 exhibits in connection with the murder of an un-named infant.
(16) Arsenic in a pot and spoon in a case of attempted poisoning.
(17) 10 grains Powdered glass in boiled rice.
(18) Ground glass in faeces of a person.
(19) Copper Sulphate in a liquid used in an attempt to commit suicide.
(20) Ultramarine (Blue) in a suspected water.
(21) Mixture of powdered Cascara Sagrada and Belladonna leaves in a powder causing death.
(22) Human tissue ex-finger of a suspected burglar.
(23) Arsenite of Soda in 12 ears of corn.
(24) Arsenic (Rough on Rats) in a powder suspected of causing death.
(25) 50 grains Cooper's Dip in a liquid used by a suicide.
(26) Plaster of Paris on feathers.
(27) White precipitate in an ointment in a case of suspected poisoning.
(28) 7 grains Powdered glass in cornmeal porridge.
(29) 2½ grains Powdered glass in cornmeal porridge.
(30) Castor Oil in a suspected liquid.
(31) Lysol in two liquids and a glass used in a case of attempted suicide.
(32) Hydrocyanic Acid from Cassava suspected of causing death.
(33) 2.25 grains Arsenic in poisoned cake.
(34) Cooper's Dip in a liquid suspected to have been used to poison cake.
(35) Chenopodium Ambrosioides in a suspected bush.
(36) Red mould in a case of suspected poisoned rice.
(37) Carbolic Acid (Jeyes' Fluid) in a suspected liquid.
(38) Cresols from water from Kingston Harbour suspected of causing death of fish.

During the year 369 Certificates were issued to the Police Department, being an increase of 82 over last year and 99 over 1931.

Human viscera and organs submitted numbered 101 as compared with 91 for the previous year.

The number of exhibits examined in cases of suspected poisoning was 143 as against 154 last year.

A case in which general interest was aroused towards the end of the year was in occurrence with the poisoning of fish in Kingston Harbour in the vicinity of Bournemouth and along the adjoining shore. Analysis of dead fish taken from a "Crawl" showed that the fish had been poisoned by cresols which evidently came from tar acids. The concentration of cresols in the water from the spot where a number of fish died was about one part in 100,000 of water. Analysis of water taken from the same vicinity two days later showed that the concentration of cresols had dropped to below one part in a million of water. The presence of the cresols was ascribed to drainage of storm water from tarred roads into the Harbour, and to the temporary diversion of the stream of polluted water from its normal course out to sea through the Port Henderson passage due to abnormal weather conditions. In view of this case of fish poisoning it may be advisable to conduct investigations into the occurrence of traces of tar acids in different parts of the Kingston Harbour during periods of heavy rains.

Several series of experiments were made in connection with six shot guns and two revolvers which were exhibits in cases of murder. Additional data was obtained concerning the spread of shot from various cartridges and guns which were fired at different ranges and under varying wind conditions.

In one case of murder experiments showed that a fragment of blood stained bark, which was picked up near the scene of the crime, came from a broken stick which was traced to the accused, who was ultimately convicted and executed.

Arson exhibits, which numbered 44, showed an increase over the number for last year which was 28.

In connection with a case of alleged forgery a cheque was submitted for examination of the ink and also a fountain pen which was taken from the accused person. Experiments showed that two different inks had been used in filling out the writing on the cheque, and that both inks differed from that in the pen. The accused person was eventually discharged on a nolle prosequi.

A great increase in counterfeit coining and manufacture of spurious bank notes resulted in a total of 814 specimens, comprised of 401 coins, 7 notes and 406 counterfeiting exhbits being submitted for analysis. This is an increase of 418 above the number submitted last year under this heading. The seven notes were each found to be counterfeit, and the colouring was done by means of crayons.

Under the Dangerous Drugs Law a total of 593 specimens were examined as compared with 760 for the previous year. Both Opium and Ganga showed a substantial reduction in the number of exhibits submitted for analysis.

216 samples were analysed under the Spirit License Law, which was an increase of 102 more than for 1932.

For Breach of the Medical Law 154 specimens of quack medicines were submitted, being an increase of 56 above last year. In one case where a quack had charged four shillings for a half-pint of liquid which was supposed to be a "cure-all," it was found that the liquid was plain water. The majority of the samples consisted of decoctions of such things as asafoetida, kola nuts, various native bushes and herbs, Epsom salts and Glauber salts, ferric chloride, ferrous sulphate, and preparations of cinchona. One quack medicine was found to be a solution of Copper sulphate in water.

40 samples of Patent Medicines were submitted in connection with test cases brought by the Police for prosecution of unregistered persons for selling preparations which might come within the scope of the Sale of Drugs and Poisons Law. In cases of certain well known Patent Medicines which contained poisons such as Arsenic and Strychnine it was found that the total contents of the bottles supplied contained far less than a fatal dose of such poison, and in such cases where prosecutions were instituted the defendants were admonished and discharged. In cases of the sale of proprietory disinfectants, such as Lysol, by unregistered persons the parties were convicted and fines inflicted.

Two samples of locally manufactured medicines, made by two different firms were found to consist of solutions of Epsom salts mixed with alcoholic extracts of senna and other vegetable matter. In both cases it was found that methylated spirit had been used in these preparations instead of undenatured alcohol.

For the Customs Department 256 samples were analysed as compared with 205 for last year. As usual these comprised a variety of substances as shown by the detailed list enumerated above.

The number of samples analysed for the Department of Science and Agriculture was only seven, which is ten less than last year. The small number of samples is accounted for owing to the majority of samples which used to come from this source now being dealt with by the Agricultural Chemist.

Two samples of waxes were analysed to determine whether they contain any Beeswax, the importation of which is prohibited by Law. One sample proved to be carnauba wax, whilst the other was a mixture of paraffin wax and carnauba wax.

21 samples were submitted by the Island Medical Department. One sample consisted of a concentrated solution of extract of ackee. This was submitted on account of the deaths of two persons whose viscera was found to contain oxalic acid, and as these persons were reported to have eaten ackees prior to death the Medical Officer suspected that ackees might contain oxalic acid. Analysis of the extract of ackee showed that no oxalic acid was present.

Out of 88 samples of foodstuffs submitted by the Medical Officers of Health for the Island, 80 samples came from Kingston and St. Andrew.

For the Department of Public Works, 10 samples were examined of which 9 were samples of native corn for ascertaining their suitability for feeding stock. Two out of the nine samples were condemned as being unsuitable for feeding stock.

The remaining 23 samples were miscellaneous articles submitted by other Government Departments.

With regard to the 1,329 general samples under heading "B," the majority, which numbered 1,028, were samples of milk from the Government Stock Farm. The milk from this source maintained its excellent quality, being above the legal standards of 3.5% of Milk Fat and 8.25% of Milk Solids-other-than-Fat.

49 samples of Cattle Dips were analysed for their content of Arsenious acid, and advice was given to the owners of Pens concerning the quantities of ingredients to add to bring their dipping tank contents up to standard strength.

Sugars and Rums were about the same as last year.

11 alcoholic liquors were submitted by traders who wished to export their goods to the United States in consequence of fresh markets in that country.

11 samples of potable and boiler-feed water were analysed, and advice given re the treatment of the same to improve the quality.

3 samples of liquids alleged to be strong methyl alcohol were found to be methylated spirits containing from 5 to 10% of methyl alcohol.

Two deposits which separated when ice was prepared in a mineral water factory were found to consist of salts of calcium and magnesium which had separated from the hard water employed in the manufacture of ice. It was demonstrated that as the water froze the ice separated leaving the dissolved salts more and more concentrated in the residual water until finally a deposit of salts separated in the centres of the blocks of ice. Recommendations were made whereby this trouble could be avoided in future.

Some zinc sheets, which had corroded in patches, were analysed and the cause of corrosion was found to be due to attack of the metal where it was subjected to the drippings of dilute alkaline fluids.

The other samples of a miscellaneous nature call for no particular comment, as they were of such a nature as involved routine analyses only and did not call for special investigations.

During the year technical advice was given in respect of five Patent applications.

The manufacture of Paranaph and Fly-killer was continued throughout the year. The local demand for Fly-killer shows a large and steady increase for the past three years as the Public are now becoming aware of its availability.

The following tables show the nature and amounts of materials supplied to the Public for the past five years, and also the amounts collected in fees and for sales during the same period.

	1929.	1930.	1931.	1932.	1933.
Paranaph	37,849	33,512	36,770	34,965	39,850 lbs.
Arsenite of Soda ..	21,725	20,175	25,499	22,021	24,818 lbs.
Copper Sulphate ..	275	70	160	567	8 lbs.
Carbon Bisulphide ..	493	516	669	1,174	2,010 lbs.
Rat Poison, bulk ..	265	162	175	225	210 lbs.
Rat Poison, 1 oz. pkts.	nil.	65	169	170	nil pkts.
Thymol Powders ..	330	466	199	441	393 ozs.
Standard Iodine Solution	47,750	41,750	39,000	40,750	45,000 c.cs.
Starch Solution ..	237	211	221	209	245 bottles
Soda Bicarbonate ..	58	48	52	30	44 bottles
Cyanogas	nil	76	170	42	29 lbs.
Fly Killer	nil	194	53	132	229 gals.
Fees	£204 1 0	£274 3 6	£191 18 0	£221 10 9	£179 8 0
	£937 19 9	£841 8 3	£989 10 7	£928 13 11	£1,073 8 4

2,071 Letters, orders, etc., were received and dealt with during the year. This number is not inclusive of personal orders dealt with.

During the year Mr. D. C. Davis, Apprentice, left the Laboratory on the 11th March, and was replaced by Mr. R. D. Hill.

Mr. H. B. Cole, Technical Assistant, who had served in the Laboratory since 1922, both as Apprentice and Technical Assistant, was promoted to the grade of Second Class Clerk and transferred to the Treasury in November.

Mr. D. C. Davis, former Apprentice, was appointed as Temporary Technical Assistant in December to fill the vacancy caused by Mr. Cole's promotion.

The Staff of the Chemical Laboratory consists of the Deputy Island Chemist, the Assistant to the Deputy Island Chemist, two Temporary Technical Assistants, two Apprentices and the Clerk and Storekeeper.

W. L. Barnett,
M.A., B.Sc., F.I.C., Dep. Island Chemist.

Report of the Agricultural Chemist for 1933.

A. INTRODUCTION.

The work of the Agricultural Chemistry laboratory during the year has been concerned mainly with extending and amplifying the study on soils and soil types commenced in 1932. The results of the broad survey commenced last year have been completed and published in a report during the present year. These results have been used as a basis for the present more extended study. Considerable information with regard to the characteristics of the soils of Jamaica is being obtained.

In most respects the routine work has changed little from that of the previous year. Increased facilities for testing cane juices and sugar house products in the laboratory have been acquired, and it is hoped to extend the study of factory problems. Several subsidiary investigations which include subjects such as the preparation of A. I. V. Silage, the irrigation waters of the Liguanea Plain, field methods of chemical analysis, the hand sugar refractometer, have been undertaken.

The first series of field experiments on sugar cane has been reaped during the year, and results of value have been obtained. A number of the experiments were affected by the high winds. The conclusions drawn from an experiment, the results of which are somewhat dependent on weather conditions and the cumulative effects of the treatments, are obviously incomplete when they are based on results obtained during one growing season only. Many experiments have therefore been continued for a further year. Additional experiments based on suggestive information obtained from the present series have also been commenced.

The manurial experiments with bananas laid down during the year suffered severely from weather conditions. Fruit have been reaped from one experiment only. Even this experiment was affected so severely that it is impossible to draw definite conclusions from the results.

The faith in the value of manures to crops of the island is increasing, though few records of the increased yields due to manures have been kept and little is known of the economic value of the manures. The use of manures on sugar cane is general, though there is little information available with regard to the optimum quantity or composition of the manures required. Artificial manures are being more widely used on bananas. There is even less information available with regard to the type and quantity of manure required by bananas than by sugar cane. Moreover, much of the information which is available is based more on general observation than on comparative yield records. Information relative to the use of manures apart from that obtained from Departmental Experiments is slowly being accumulated. Planters have been encouraged to undertake their own experiments in co-operation with the Department. When such co-operative experiments are established, the planter concerned supplies all the material requirements of the experiment while the Department undertakes to design an experiment suitable for the particular conditions of the estate, and, when possible, to supply any special supervision required in the application of the manures and reaping of the crop. Several planters have instituted experiments of this type, and are obtaining results of value to themselves and to the industry as a whole.

A step of considerable importance to the sugar industry of the island has been taken during the year by a group of the smaller and older type factories by providing facilities for the chemical control of their sugar production. The necessity of maintaining an accurate account of the sugar entering and leaving the factory and of determining the sources of waste has been less apparent in these smaller than in the larger factories. The low price of sugar and the natural reticence to make an apparent increase in production costs have delayed the adoption of these facilities. The necessity for more rigorous control has been emphasised by the loss of the rum market and the consequent need for a more efficient production of sugar.

Yields of the seedling canes which now represent a high proportion of the cane yields of the island have been collected and summarised for the first time. It is intended to collect such information each year and possibly to extend the scope of the records so obtained.

The division of Agricultural Chemistry has been presented by Mr. John R. Roebling of New Jersey with a complete spectroscopic outfit for the determination of "trace elements" in soils and plants. The apparatus opens an entirely new field in the study of soils and plants in Jamaica. The planting community of the island is deeply indebted to Mr. Roebling for his most generous gift.

B. SOIL SCIENCE AND AGRICULTURAL CHEMISTRY.

1. SOILS.—

(A) General Survey Work.—The work commenced in 1932 of obtaining samples of soil representative of the soil types existing in Jamaica has been continued. The samples have been examined in the laboratory with a view of determining the main characteristics of each type of soil. The examination is essential for the study of the more detailed problems of soil fertility and crop production which abound. The work has been forwarded considerably by a rapid all-island survey undertaken during 1932 in conjunction with Prof. F. Hardy of the Imperial College of Tropical Agriculture. The results of that survey have been published during the past year and they offered a valuable framework on which to plan a complete study of the soils of Jamaica. The year's work relative to the study, after completing the work entailed by the survey, has been mainly concerned in extending the areas under survey and establishing where possible the generalisations suggested in the report.

The examination of soils from estates having definite soil problems has been continued. The examinations have been conducted in such a way as to contribute general information of the general characteristics of the particular soil types occurring on the estate, as well as direct information bearing on the particular problem under study. The majority of soils studied in this way have been growing sugar cane or bananas. A few citrus producing soils have been studied.

The method of approach to the study of the soils of Jamaica, while it provides information immediately for individual areas, tends to retard the progress of the more general survey work. The result has been that it has not yet been possible to inspect soils in all areas, and only very few samples have been obtained from certain soil types.

The sedentary soils derived from the main geological rock types occurring in Jamaica, exhibit as far as has been ascertained, definite and fairly constant characteristics. These characteristics have been summarised for each of the main soil types. Local conditions and variations occur in the soil, but which cannot be considered in this brief summary. A geological Plan of Jamaica based on the map by R. T. Hill is reproduced from the publication, "Some Soil Types of Jamaica."

(i) *Recent Alluvial Soils:*—Small areas of recent alluvial soils occur on the immediate banks of most of the larger rivers of Jamaica. The derivation of these soils is so complex that their properties vary considerably within small areas. It is therefore impossible to make any generalisations on these river soils. Included in this type are the raised Coral Reef Soils occurring along the north coast. These soils are generally shallow black soils often very stiff and compact. They are alkaline in reaction and generally contain large amounts of calcium carbonate. They have a high content of organic matter. They contain medium low amounts of available potash and phosphate. They are good sugar cane soils.

(ii) *Old Alluvial Soils:*—

Liguanea Plain·—The Liguanea Plain soil is very variable in texture, but except in places where it is very stony, tends to become very sticky when wet, and very hard when dry. There is very little variation with depth. It is characteristically purplish brown in colour. It is alkaline in reaction, has very low nitrogen and organic matter contents. The available phosphate content is high, and the available potash content medium low. On the whole, these soils are very productive for all crops.

St. Catherine and Clarendon Plains.—The soil is so variable that it is impossible to summarise its characteristics in a small space.

(iii) *Inland Basin Alluvium.*—

Trelawny Sugar Cane Soils.—The soil varies in texture from a light loam to a clay. The surface soil is generally fairly crumbly. The surface soil is blackish brown overlying a bright yellow sub-soil. Red patches occur in the lower layers of the sub-soil. The approach of these patches to the surface indicates a soil of low fertility. The soils contain shot in varying amounts. Pen manure and artificial manures have been applied to these soils for many years. The surface soils contain a very high proportion of nitrogen. The available phosphate content is medium to high, the available potash content medium to low. There are indications that the available phosphate content of the soil has accumulated artificially from the regular applications of pen manure, and that the virgin soil may contain only small amounts. The soils are generally alkaline or slightly acidic. They produce medium to poor crops of sugar cane, but are unsuitable for bananas.

Westmoreland Sugar Cane Soils.—Very few soils of this type have been examined. The indications are, however, that they contain medium amounts of nitrogen and organic matter, low phosphate and medium to low potash. High acidity is not general, but may occur in places. These soils produce medium crops of sugar cane, and are not suited to bananas.

(iv) *White Limestone Soils.*—

The soils derived from white limestone are bright red or reddish yellow in colour, the soils in the drier areas generally being the redder. The surface is generally crumbly, and except for a slight increase in compactness, there is very little change with depth. They are generally neutral or slightly acidic, but small areas have been found in the areas of high rainfall which are highly acidic. The nitrogen and organic matter contents are medium to high, the available phosphate and potash contents are low. The soils produce good yields of citrus and coffee and are very suitable for root crops. They can produce bananas, but are not ideal banana soils.

(v) *Cambridge Bed Soils.*—

The few profiles examined on the Cambridge beds occur on the Yellow Limestone. The profiles exhibit black clay surface soil overlying a heavy pale yellow clay. The surface soil is neutral or slightly acidic, but some cases have been found where the sub-soil has been highly acidic. The nitrogen and organic matter contents are medium to high. The available phosphate content is low to very low and the available potash content medium to high. These soils are considered to be very infertile though bananas can be produced on them in certain areas.

(vi) *Richmond Bed Soils. (St. Mary Area).*—

The Richmond Bed soils are normally dark brown and friable on the surface, changing below to a pale yellow clay mottled with orange. The surface soils are frequently highly acidic, though below a depth of three feet they may be calcareous and alkaline. The nitrogen content is medium high, the organic matter content medium, the available phosphate content low to very low, and the available potash high to very high. These soils are fairly good banana soils, and when not highly acidic are good sugar cane soils.

The Richmond Bed Soils in the Hanover Area have not been examined in sufficient detail to enable generalisations to be made.

(vii) *Trappean Shales and Conglomerates (Cambridge Area).*—

The soils derived from the Trappean Shales and Conglomerate are deep, red brown and friable on the surface, and are yellow patched with red in the sub-soil. The surface soils are fairly friable, but the sub-soils may be heavy clays. The soils are frequently highly acidic. They contain medium amounts of nitrogen and organic matter. The phosphate content is very low, and the potash content high to very high. The soil is usually first class hill side banana soil.

(B) Micro-chemical Soil Tests.—A series of tests for determining the available plant nutrients in soils, and which can be performed with a minimum requirement of apparatus and chemicals, has been devised by M. F. Morgan (Bull. 333, Conn. Agric. Expt. Stat.). The tests can be performed by any intelligent person and without the usual laboratory facilities, although to obtain consistent results great care and precision are required. Owing to the interest of a number of planters, an investigation was under taken to compare the results of these tests with the results from the more elaborate laboratory tests. A large number of analyses of different types of soils have been performed by both the micro-chemical tests and the laboratory methods.

The following paragraphs summarise the conclusions which have been drawn from the investigation.

Acidity Test or pH Test.—The acidity test is made by using a series of three indicators. The pH values obtained were generally within 0.2 of those obtained by the electrometric method. The test with heavy clays had to be performed with particular care or erroneous results were obtained.

Nitrate Test.—The determination of Nitrate is based on the standard diphenylamine method on a water extract of the soil. The estimation of the nitrate content of the soil by the micro method was not investigated fully. The results obtained were variable. The conclusions which may be drawn from a determination of the nitrate content are, in any circumstances, difficult to interpret. The nitrate content of a soil varies considerably with changes in the weather and the cultural condition of the soil, and two similar soils sampled under different conditions may give widely differing results for the test.

Available Phosphate Test.—The available phosphate is extracted from the soil by dilute acid and is estimated by a modified Deniges method. The determination of available phosphate by the micro test gave results which bore a close relationship to those derived by the Truog method which is in routine use in the laboratory. The results from the test gave a valuable indication of the available phosphate content of the soil. Duplicate determinations by the method gave identical results.

Available Potash Test.—The micro test for available potash is based on extraction with acetic-acetate solution, precipitation of potassium sodium cobalti-nitrate in the presence of alcohol, and the estimation of the amount of precipitation by an ingenious nephelometric method. Results could be replicated accurately. The results obtained were very similar to those obtained by routine acetic acid extraction method, though discrepancies occurred when very small and very large amounts of potash were available. Certain soils with high organic matter contents, or high exchangeable iron contents gave results not in accordance with the standard method. About thirty-six determinations could be completed in a day.

The micro tests on the whole gave results in good accordance with those obtained from the more elaborate methods of estimation. With the exception of the acidity determination, the main difficulty for the planters, for whose use the tests are intended, lies in the interpretation of the results. It is only after a careful study of local conditions and the results of the tests, that it would be possible to interpret the results into terms of artificial manures.

(c) Summary of Work on Soil Samples.—The methods in use in the laboratory enable a relatively large number of soil samples to be examined.

Total number of Soil Pits sampled (including 2′ depth and 6′ depth pits)	112
Total number of Soil Samples examined ..	686
No. of Reports issued to estates on soil determinations	30

In addition a considerable amount of laboratory work was perfomed on the samples taken during the survey of 1932.

2. GENERAL AGRICULTURAL ANALYSIS.—

The following samples of agricultural interest were submitted for analysis during the year—

Guanos (Bat and sea bird)	42
Agricultural Limes	5
Irrigation Waters	6
Irrigation Well Waters (under Liguanea Plain Survey)	16
Miscellaneous manures and manurial substances	4
Cane Juices (for Purity)	10
Total ..	83

The general quality of the natural bat guanos submitted was poor, and very few had any commerical value.

The agricultural limes were all of a high standard of purity. In many parts of the island it is cheaper to burn lime than to obtain ground limestone in a sufficiently fine state of division.

The samples of cane submitted for juice analysis were with one exception too small to enable any reliance to be placed on the results of the determinations being an indication of the true standing of the field.

3. THE IRRIGATION WATERS OF THE LIGUANEA PLAIN.—

A survey of the quality of the irrigation water in use on the Liguanea Plain was undertaken. Samples of water from all wells used for irrigation on the plain and from a few wells supplying Kingston were obtained. Samples from the Salt River were included.

The survey showed that the quality of the water obtained from the majority of the wells was excellent. Only two wells gave water with a somewhat high content of salt. The water from these two wells would be probably injurious to bananas and citrus but probably would not affect sugar cane. In all cases the major impurity was sodium chloride.

The waters of the Salt River were found to be entirely unsuitable for irrigation purposes. An examination of the salt content of the water at various points in the course of the river showed that there was no fresh water springs flowing into the river which could be tapped for irrigation.

The risk of salt accumulation in the soils of the higher areas of the Liguanea Plain is small. There is a possibility, however, that the continual use of irrigation water on the lower areas, for example on the seaward side of the Spanish Town Road, may bring toxic salts to the surface and render the land unsuitable for crops.

4. A. I. V. FODDER.—

Correspondence with Prof. Virtanen on his method of preparing silage has resulted in two experiments with the method being commenced with the co-operation of the Superintendent of Hope Farm. The advantage of this method is that the silage can be prepared without the erection of elaborate buildings. One experiment containing 9 tons of guinea corn and one containing 3 tons of guinea grass have been laid down. It is unknown whether the method originated in a cold climate will prove successful under Jamaica conditions. If good results are obtained the method should prove invaluable for the small penkeepers who wish to provide fodder for the end of the dry season.

5. HAND SUGAR REFRACTOMETER.—

A Zeiss Hand Sugar Refractometer was purchased by two planters during the year and was submitted to the laboratory for tests. The instrument enables tests for Brix values for sugar cane juice to be made in the field without the use of a mill.

The accuracy with which an estimation of the maturity of a field of cane can be obtained by use of the instrument depends upon three main factors: (a) the accuracy with which the instrument shows the Brix value of the extracted juice under local conditions, (b) the accuracy with which the small sample of juice extracted from the cane represents the average juice of the whole cane, (c) the accuracy with which a sample consisting of a limited number of canes can represent the standing of a whole field.

The three factors were approached in the following ways:—

(a) Cane juices were tested with the refractometer and with standard Brix Hydrometers. The refractometer gave slightly lower values than the hydrometers.

(b) The juice of a sugar cane is known to vary in total solids content throughout the length of the cane. Various methods of obtaining an estimate of the average content of the juice for the cane by using a minimum number of samples, were tried. Readings approximating most closely to those obtained by testing the juice from the whole cane were obtained by dividing the cane into three equal portions, making determinations on samples from the centre node of each section, and taking the mean of the three results.

(c) The difficulty of obtaining a small sample of cane which is representative of a whole field of cane has been demonstrated in many countries. It has been shown that the only method of obtaining a reasonably small sample is by careful selection of average canes. In view of this experience, the sampling method adopted

in Queensland has been recommended. It consists in selecting one cane of apparently an average degree of purity from a selected stool in each acre of the field. It has not been possible to test this method under local conditions.

It has been possible to obtain an instrument for Departmental use during the coming crop, and it is proposed to continue investigations. Provided reasonable accuracy in sampling a field of cane can be obtained easily, the instrument should prove invaluable to many of the sugar factories of Jamaica which do not possess facilities for testing a large number of cane juices.

In making the investigations recorded above, it was found that the corer for sampling supplied with the instrument was not entirely satisfactory. Improvements to the corer were discussed and submitted to the suppliers of the instruments. Corers embracing the suggested improvements are now supplied with the instrument.

6. ADVISORY WORK.—

Numerous enquiries with regard to problems related to soils and manuring have been received. Problems relating to the manuring of vegetables, of small fruits, of garden flowers, to the relative value of different manures, the value of waste products as manure, the use of cover crops, and field methods for testing for soil acidity, have been among the subjects submitted for consideration.

Demonstrations of the use of the comparator for the colorimetric control of liming of sugar cane juice have been given to individual planters. Sugar factories have been visited and the immediate problems discussed with the managers.

Standard solutions for volumetric work and of indicators have been supplied to factories.

7. PUBLICATIONS, LECTURES, Etc.—

"Some Soil Types of Jamaica" in collaboration with Prof. F. Hardy of the Imperial College of Tropical Agriculture.

Articles have been contributed to the Journal of the Agricultural Society.

A lecture was delivered during the Departmental Open Week.

The Agricultural Chemist was appointed to act as assistant Secretary to the West Indian Fruit and Vegetable Conference held during October, 1933.

Mr. R. S. Martinez, Superintendent of Agriculture has assisted in the work of the laboratory reported above, when not absent on other duties.

C. FIELD EXPERIMENTS.

The scheme of field experiments arranged for the season 1932-33 has been completed.

Several of the experiments on sugar cane, and all of the experiments on banana, have been seriously affected by the hurricane and high winds occurring during 1932 and 1933.

There have been a number of applications from planters for advice with regard to the laying out of manurial experiments. A number of these co-operative experiments, in which the planter concerned supplies all the material requirements for the experiments, while the Department undertakes to design the experiment and supply all special supervision that may be required, have been laid down.

1. SUGAR CANE.—The results of the manurial experiments with sugar cane have been recorded in a special report which will be distributed to interested planters. The following paragraphs summarise the work performed in 1932 and indicate the general results which have been obtained.

Number of Experiments reaped	11
Number of Experiments continued until 1934 and relaid during 1933	8
Number of New Experiments commenced in 1933	3

The results of field experiments performed under the conditions of one season only, however, cannot be used as a basis of a general manurial programme for an estate. Varying weather conditions will influence the effect of the manures. The effect of manuring is to some extent cumulative so that only after a manure has been applied for several years to the same land and cane can the true difference in yield obtained by the various treatments be estimated. The following of results therefore must be considered as being entirely provisional and some of the views expressed may be revised when experiments of longer duration than one crop have been completed.

(a) *Old Alluvium Formation (Vere Area).*—

Nitrogenous manures are mainly required, but potash may be required to maintain the juice purity. Possibly, owing to the use of irrigation, larger applications than have been used up to the present time may prove profitable.

(b) *Inland Basin Alluvium (Trelawny Area).*—

Nitrogen and potash appear to be the main requirements of the soils. Phosphate may be lacking in certain areas, but most of the soils examined have been receiving either artificial or pen manure for many years and appear to have an ample supply of phosphate. The amount of the most economic dressing depends mainly on rainfall and appears to be somewhat less during normal years than dressings which have been applied recently.

(c) *Coral Reef Formation.*—

The results are very inconclusive. The nitrogen status of the soils is high. The use of irrigation may enable larger dressings than those already in use to give results.

(d) *Limestone*—

The use of limestone is not required on the majority of the sugar soils of the island. The few cases where limestone is required can be readily detected and the requirement determined by chemical methods.

Experiments concerning areas not included in this summary and new experiments embracing the information already obtained are in progress.

2. BANANAS.—Five manurial experiments on bananas have been laid down during the year. The experiments have been distributed throughout the main banana growing areas of the island. All the experiments were so severely damaged by storms that no reliable results are available. Where possible the experiments are being continued during the present year, but in certain places it has been thought advisable to lay out new areas.

Two planters undertooks large plot experiments under the advice of the Department. In both cases the experiments were destroyed after a certain quantity of fruit had been reaped. Indications were obtained from the fruit which had been reaped to the effect that in one experiment the manured trees produced matured fruit considerably before the unmanured trees.

The second experiment gave indications that the application of phosphatic manure to a soil showing a high chemical deficiencyof phosphate improves the grade of the fruit.

3. CITRUS.—It has not been possible to undertake any Departmental manurial experiments with citrus during the year.

The greater part of the supervision of the field work in connection with both the sugar cane and banana manurial experiments has been undertaken by Mr. M. S. Goodman, Superintendent of Sugar Cane Experiments, and Mr. R. S. Martinez, Superintendent of Agriculture. It is due to their active co-operation in this work that accuracy in the results has been possible.

H. H .Croucher,
12.3.34.

GEOLOGICAL PLAN
OF
JAMAICA
BASED ON THE MAP
BY
R T HILL, 1898
MONTEGO BAY
E. ANNS BAY
ANNOTTO BAY
BLUFF BAY
MANCHIONEAL
KINGSTON
INDEX
GEOLOGICAL FORMATION
AGE
RECENT ALLUVIUM
RECENT
OLD ALLUVIUM
PLEISTOCENE
MANCHIONEAL BEDS
CORAL SERIES
PLIOCENE
BOWDEN BEDS
MIOCENE
WHITE LIMESTONE
OCEANIC SERIES
OLIGOCENE
CAMBRIDGE BEDS
RICHMOND BEDS
BLUE MOUNTAIN SERIES
EOCENE
CONGLOMERATES
CRETACEOUS
IGNEOUS ROCKS
SITES OF SOIL PROFILE PITS

VIII. STAFF.

Mr. A. C. Barnes arrived in the Island on 16th September, and assumed duty as Director of Agriculture and Island Chemist.

Miss M. M. McDonald was appointed Clerical Assistant in the Head Office *vice* Miss V. L. Crosskill, who was promoted to an Assistantship and transferred to the Revenue Department.

Mr. O. L. Carnegie was appointed an Inspector of Plant Diseases *vice* Mr. E. M. Falloon.

Mr. D. C. Davis was appointed a Technical Assistant in the Government Laboratory *vice* Mr. H. B. Cole promoted Second Class Clerk and transferred to the Treasury.

Mr. J. W. Howe, Headmaster of the Farm School, was absent from the Island between 4th October and 15th November on a mission to the United States to study the system of Agricultural and Vocational Education in the Southern States.

Mr. F. E. V. Smith, Microbiologist, was absent from the Island between 16th November and 17th December on a mission to Central America and Florida for the purpose of studying the Citrus Industry of those countries and of obtaining supplies of selected budwood for the Departmental Citrus Nurseries.

The following officers were granted leave during the course of the year:—

Head Office:—	
Mr. R. A. White	6 weeks
Superintendent's Office—	
Miss E. Marson	6 weeks
Farm School:—	
Dr. S. Lockett	8 months
Mr. V. A. Valentine	8 months
Mr. L. A. Powell	6 weeks
Government Laboratory—	
Mr. W. L. Barnett	3 weeks
Mr. E. N. Richards	2 months
Mr. L. A. Boothe	8 weeks
Mr. E. K. P. Blake	2 weeks
Grove Place—	
Mr. A. F. Thelwell	3 months
Inspectors of Plant Diseases—	
Mr. S. O. Coy	1 month

Mr. W. H. Edwards, Entomologist returned to the Island on 8th February, and resumed his duties after an absence of four months on leave.

Mr. J. Briscoe, Senior Travelling Instructor, retired on 30th June, 1933, on the ground of age, after 34 years continuous service in the Department.

Mr. L. A. Wates, Junior Travelling Instructor, was appointed temporarily to act as Senior Instructor and Mr. A. P. Hanson of the staff of the Jamaica Agricultural Society was seconded to act as Junior Instructor.

(Sgd.) A. C. Barnes,
Director of Agriculture and Island Chemist.

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